# CMMI® Version 1.2 and Beyond
# Systems and Software Technology Conference
## 29 April 2008

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Software Engineering Institute
Carnegie Mellon University

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With thanks to Denise Cattan, Sandra Cepeda, Pascal Rabbath, and Gary Wolf for contributions.



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# CMMI Today


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# CMMI Transition Status
# As reported to the SEI as of 12-31-07

**Training**

Introduction to CMMI – 79,784

Intermediate CMMI – 2,678

Understanding CMMI High Maturity Practices – 286

**Authorized**

Introduction to CMMI V1.2 Instructors – 440

SCAMPI V1.2 Lead Appraisers – 487

SCAMPI V1.2 B&C Team Leaders – 470

Certified V1.2 High Maturity Lead Appraisers – 130


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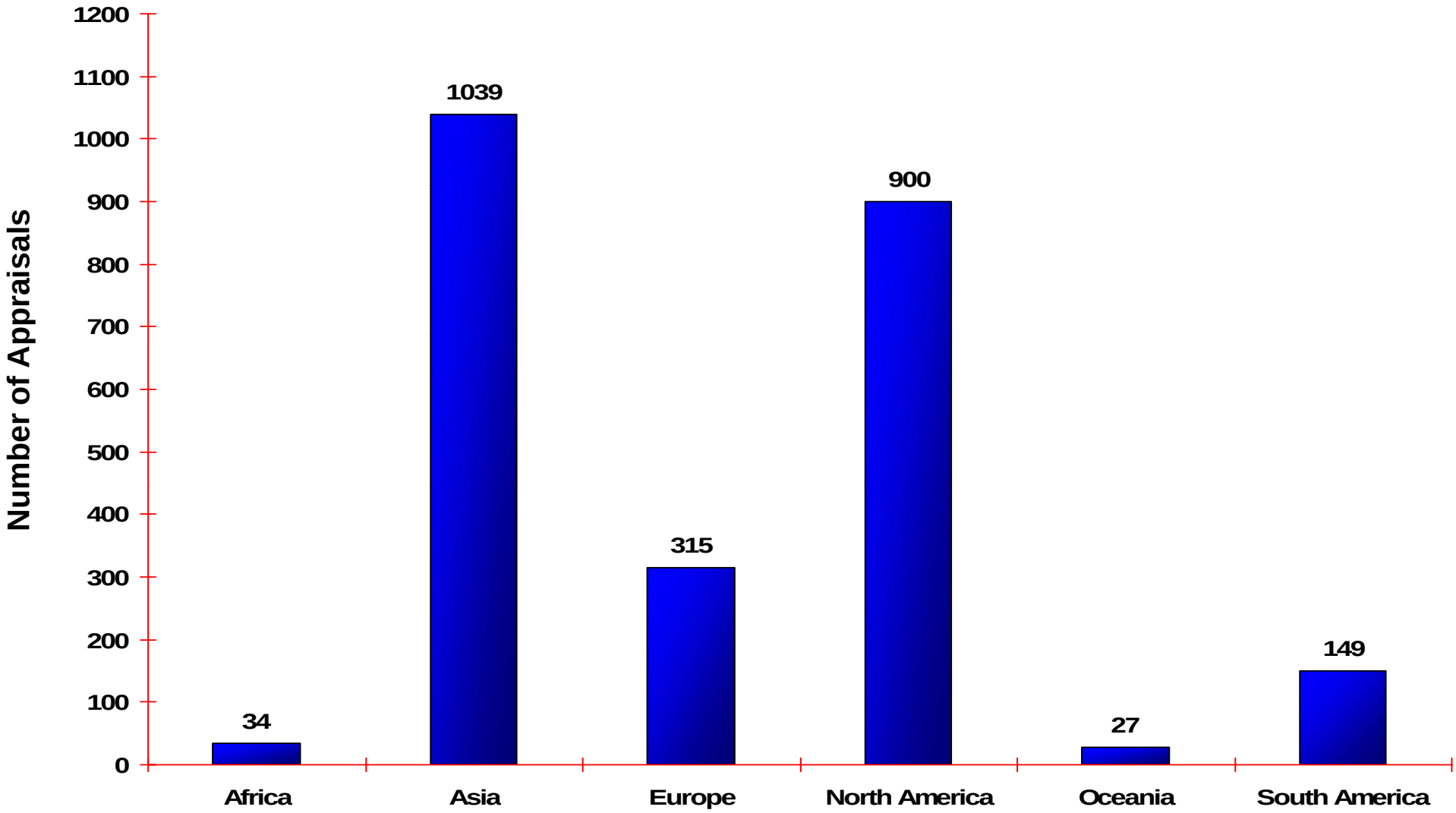
# Number of Appraisals Reported to the SEI (by Continent)





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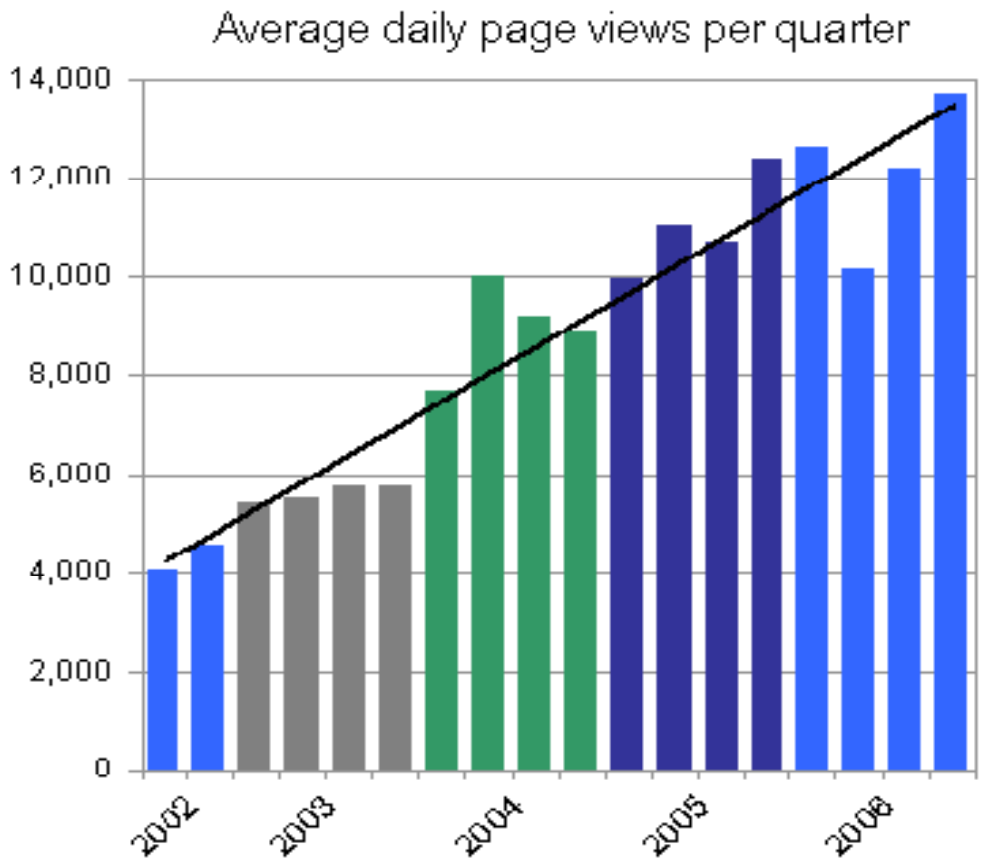
# CMMI Adoption, Web Views

421K views/month in Q4 2006; over 24K views on 27 Sep 2006

Most downloaded files in Q4 2006

- CMMI-DEV, V1.2
- CMMI V1.2 Overview Presentation
- "Extreme Programming (XP), Six Sigma, & CMMI: How They Can Work Together"
- "CMMI V1.2 Model Changes" Presentation





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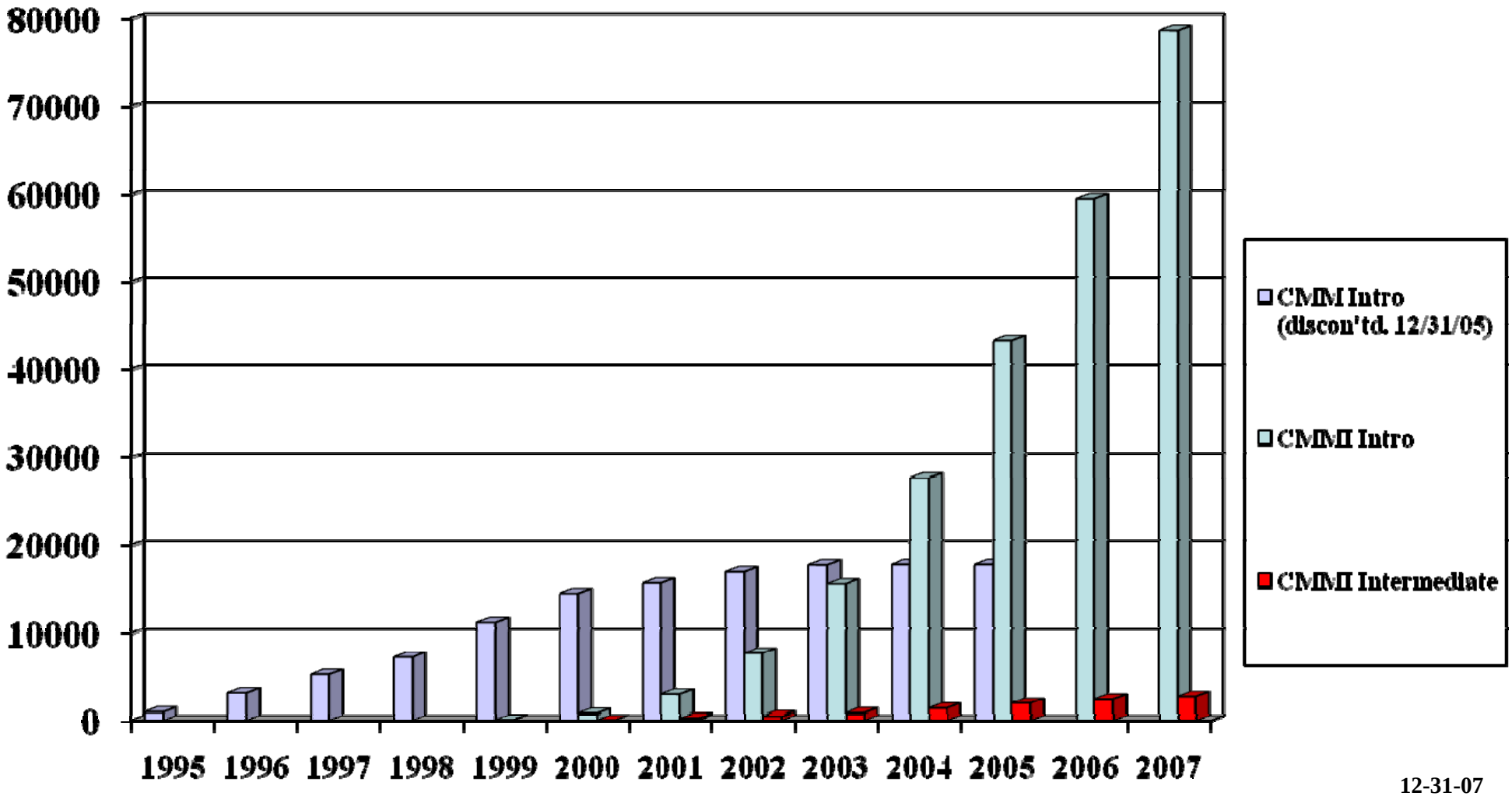
# Intro to the CMM and CMMI Attendees (Cumulative)




12-31-07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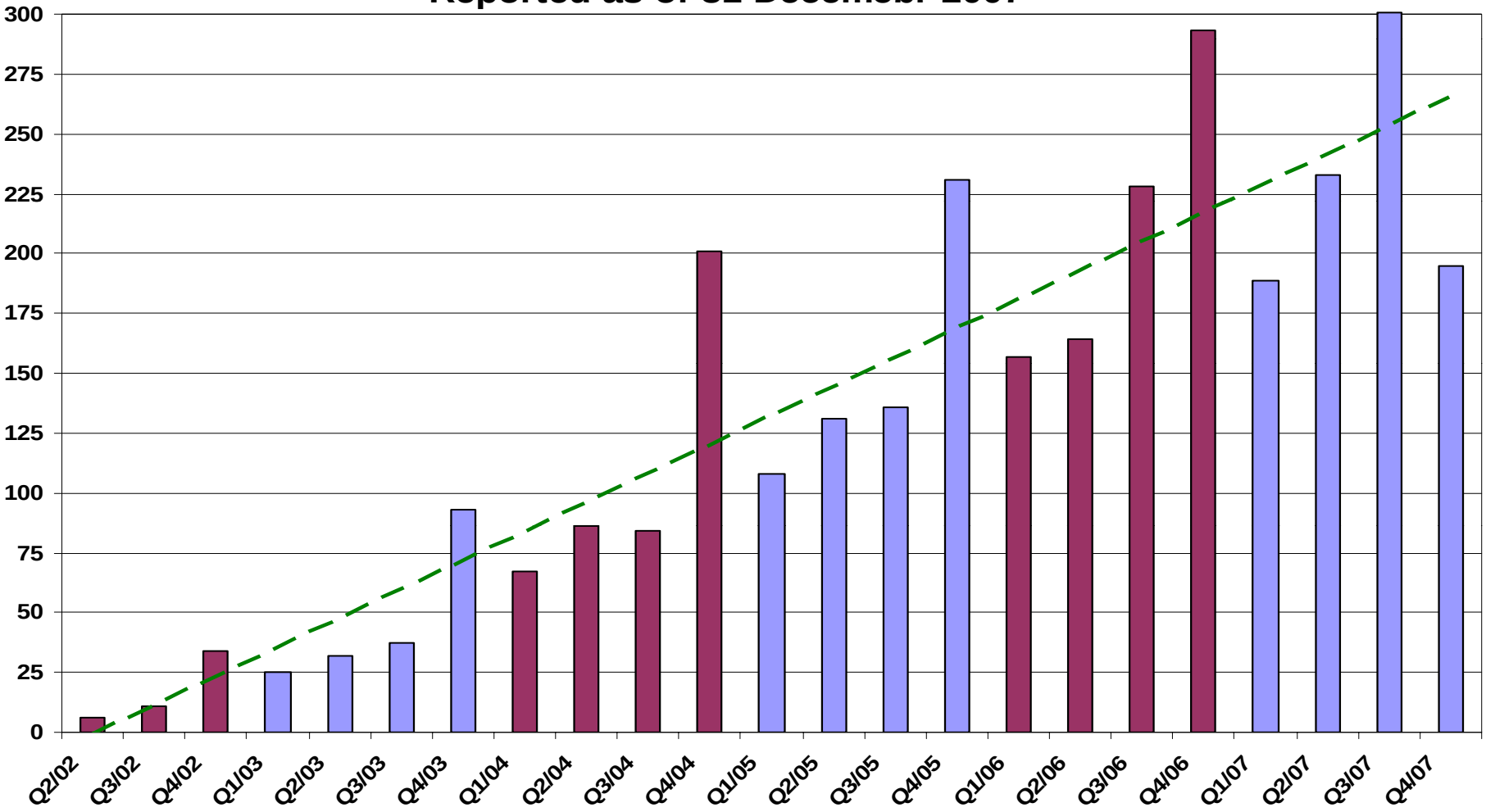
## Number of SCAMPI v1.1/v1.2 Class A Appraisals Conducted by Quarter Reported as of 31 Decemebr 2007





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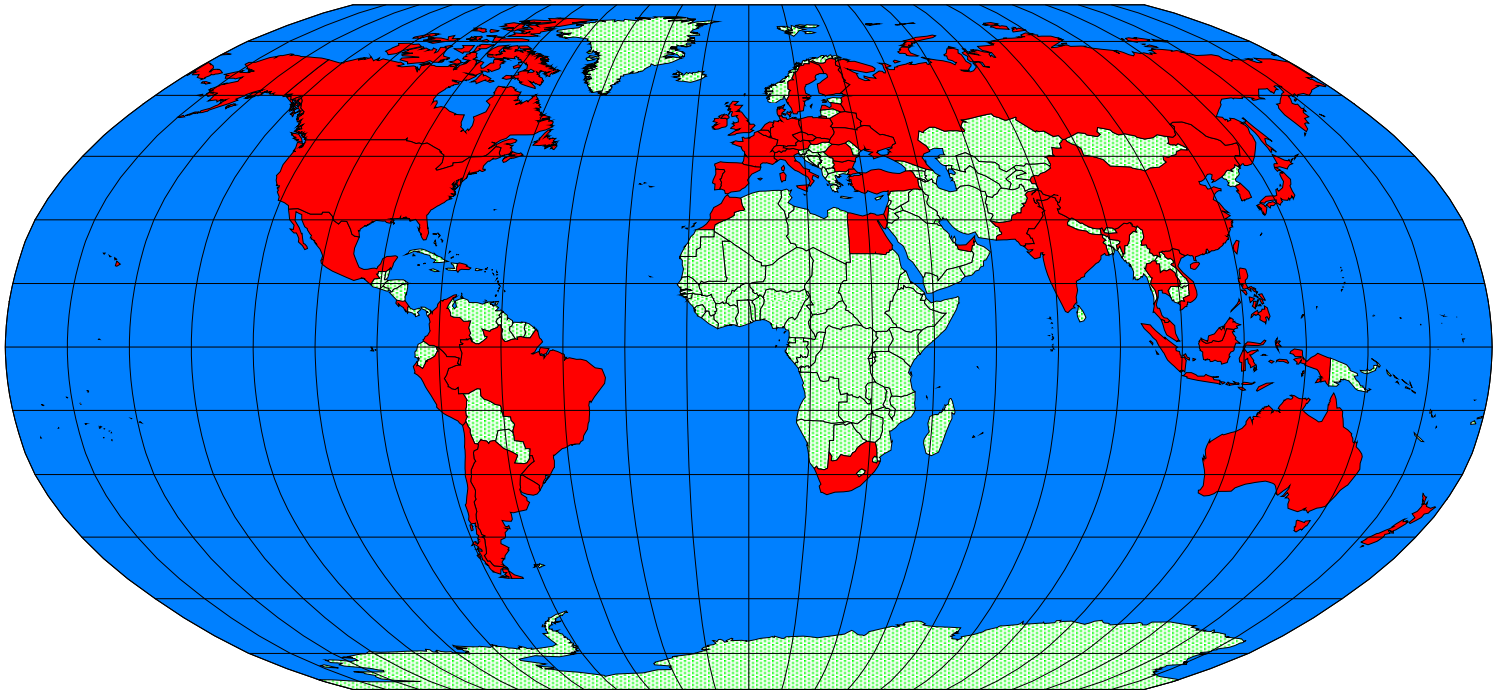
# Countries where Appraisals have been Performed and Reported to the SEI



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Argentina | Australia | Austria | Bahrain | Belarus | Belgium | Brazil | Bulgaria |
| Canada | Chile | China | Colombia | Costa Rica | Czech Republic | Denmark | Dominican Republic |
| Egypt | Finland | France | Germany | Hong Kong | India | Indonesia | Ireland |
| Israel | Italy | Japan | Korea, Republic Of | Latvia | Malaysia | Mauritius | Mexico |
| Morocco | Netherlands | New Zealand | Pakistan | Peru | Philippines | Poland | Portugal |
| Romania | Russia | Singapore | Slovakia | South Africa | Spain | Sweden | Switzerland |
| Taiwan | Thailand | Turkey | United Kingdom | Ukraine | United Arab Emirates | United States | Uruguay |
| Viet Nam | | | | | | | |

Red country name: 2007 additions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# Number of Appraisals and Maturity Levels Reported to the SEI by Country

| Country | Number of Appraisals | Maturity Level 1 Reported | Maturity Level 2 Reported | Maturity Level 3 Reported | Maturity Level 4 Reported | Maturity Level 5 Reported | Country | Number of Appraisals | Maturity Level 1 Reported | Maturity Level 2 Reported | Maturity Level 3 Reported | Maturity Level 4 Reported | Maturity Level 5 Reported |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 26 | No | Yes | Yes | Yes | Yes | Malaysia | 29 | No | Yes | Yes | No | Yes |
| Australia | 26 | Yes | Yes | Yes | Yes | Yes | Mauritius | 10 or fewer | | | | | |
| Austria | 10 or fewer | | | | | | Mexico | 29 | Yes | Yes | Yes | Yes | Yes |
| Bahrain | 10 or fewer | | | | | | Morocco | 10 or fewer | | | | | |
| Belarus | 10 or fewer | | | | | | Netherlands | 10 or fewer | | | | | |
| Belgium | 10 or fewer | | | | | | New Zealand | 10 or fewer | | | | | |
| Brazil | 58 | No | Yes | Yes | Yes | Yes | Pakistan | 10 or fewer | | | | | |
| Bulgaria | 10 or fewer | | | | | | Peru | 10 or fewer | | | | | |
| Canada | 38 | No | Yes | Yes | Yes | Yes | Philippines | 17 | No | Yes | Yes | No | Yes |
| Chile | 17 | No | Yes | Yes | No | Yes | Poland | 10 or fewer | | | | | |
| China | 321 | Yes | Yes | Yes | Yes | Yes | Portugal | 10 or fewer | | | | | |
| Colombia | 16 | No | Yes | Yes | Yes | Yes | Romania | 10 or fewer | | | | | |
| Costa Rica | 10 or fewer | | | | | | Russia | 10 or fewer | | | | | |
| Czech Republic | 10 or fewer | | | | | | Singapore | 10 | | | | | |
| Denmark | 10 or fewer | | | | | | Slovakia | 10 or fewer | | | | | |
| Dominican Republic | 10 or fewer | | | | | | South Africa | 10 or fewer | | | | | |
| Egypt | 25 | No | Yes | Yes | Yes | Yes | Spain | 55 | No | Yes | Yes | Yes | Yes |
| Finland | 10 or fewer | | | | | | Sweden | 10 or fewer | | | | | |
| France | 94 | Yes | Yes | Yes | Yes | Yes | Switzerland | 10 or fewer | | | | | |
| Germany | 41 | Yes | Yes | Yes | Yes | Yes | Taiwan | 71 | No | Yes | Yes | No | Yes |
| Hong Kong | 10 | | | | | | Thailand | 10 or fewer | | | | | |
| India | 256 | No | Yes | Yes | Yes | Yes | Turkey | 10 or fewer | | | | | |
| Indonesia | 10 or fewer | | | | | | Ukraine | 10 or fewer | | | | | |
| Ireland | 10 or fewer | | | | | | United Arab Emi | 10 or fewer | | | | | |
| Israel | 12 | No | Yes | Yes | No | Yes | United Kingdom | 57 | Yes | Yes | Yes | Yes | Yes |
| Italy | 12 | No | Yes | Yes | No | No | United States | 859 | Yes | Yes | Yes | Yes | Yes |
| Japan | 197 | Yes | Yes | Yes | Yes | Yes | Uruguay | 10 or fewer | | | | | |
| Korea, Republic Of | 87 | Yes | Yes | Yes | Yes | Yes | Viet Nam | 10 or fewer | | | | | |
| Latvia | 10 or fewer | | | | | | | | | | | | |


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# Beyond CMMI V1.2...

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# Beyond V1.2 Themes

- Certification of our process improvement professionals is appropriate and achievable
  - Lead Appraisers first
  - Instructors
  - CMMI consultants/practitioners
- Improved architecture allows process improvement model expansion.
  - Extensions of the life cycle
    - allows coverage of more of the enterprise or potential partnering organizations
    - adapts model features to fit non-developmental efforts


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# Certification Efforts

The transition from authorization to certification for SCAMPI LA's includes all currently authorized and candidate SCAMPI Lead Appraisers. Quality improvement efforts are

- The SCAMPI Lead Appraiser Body of Knowledge (SLA BOK), developed by the SEI and community experts to provide professional guidance for all LAs.
- A new SCAMPI LA written exam based on competencies identified in the SLA BOK is underway, with a release planned for 2008
- Exam development will follow industry standards for assessment validation


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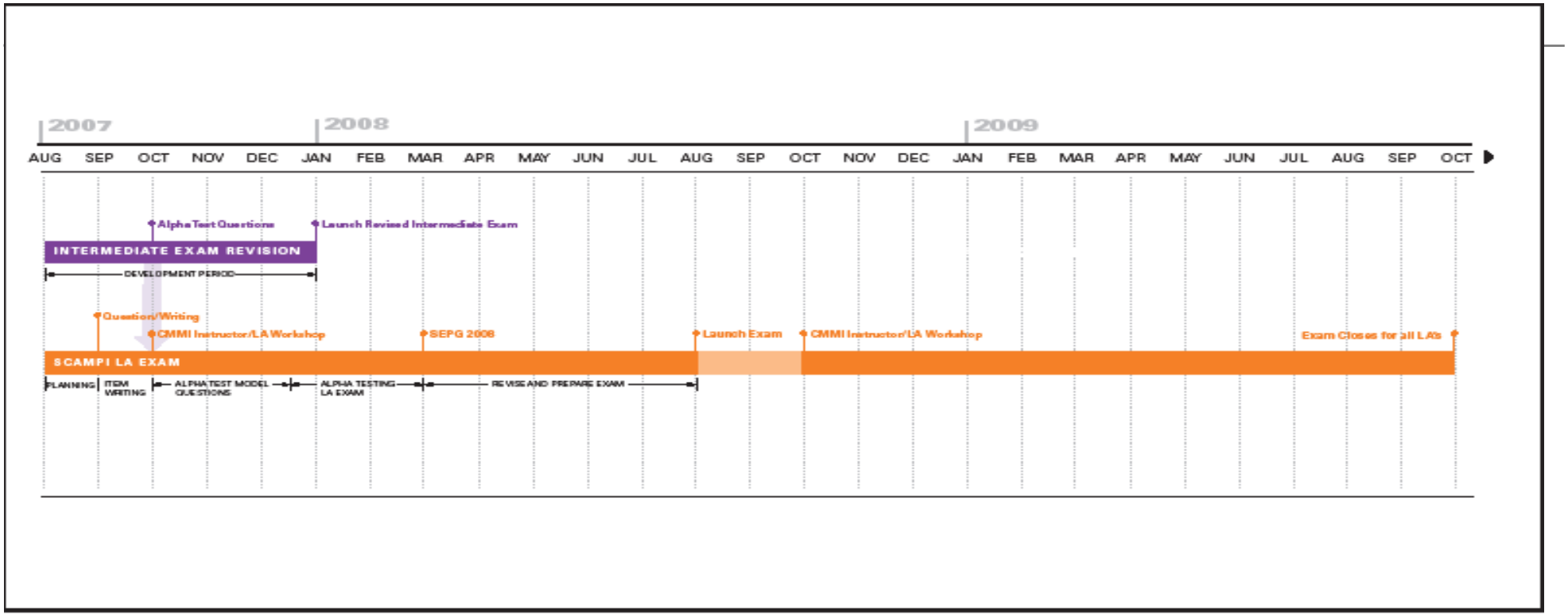
# Certification Exam Project Timeline





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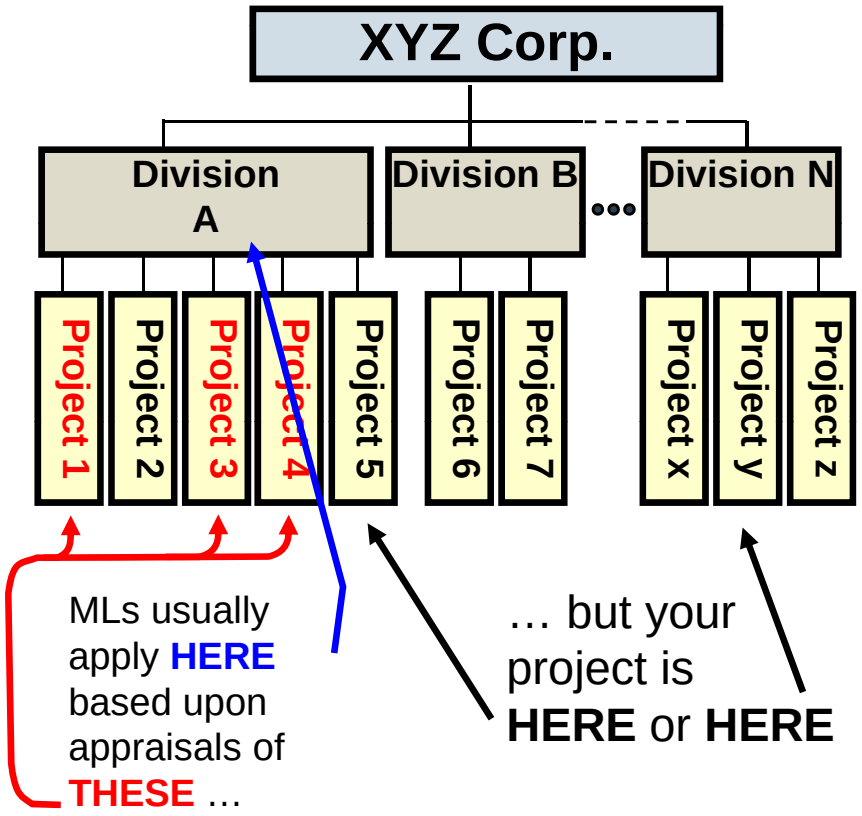
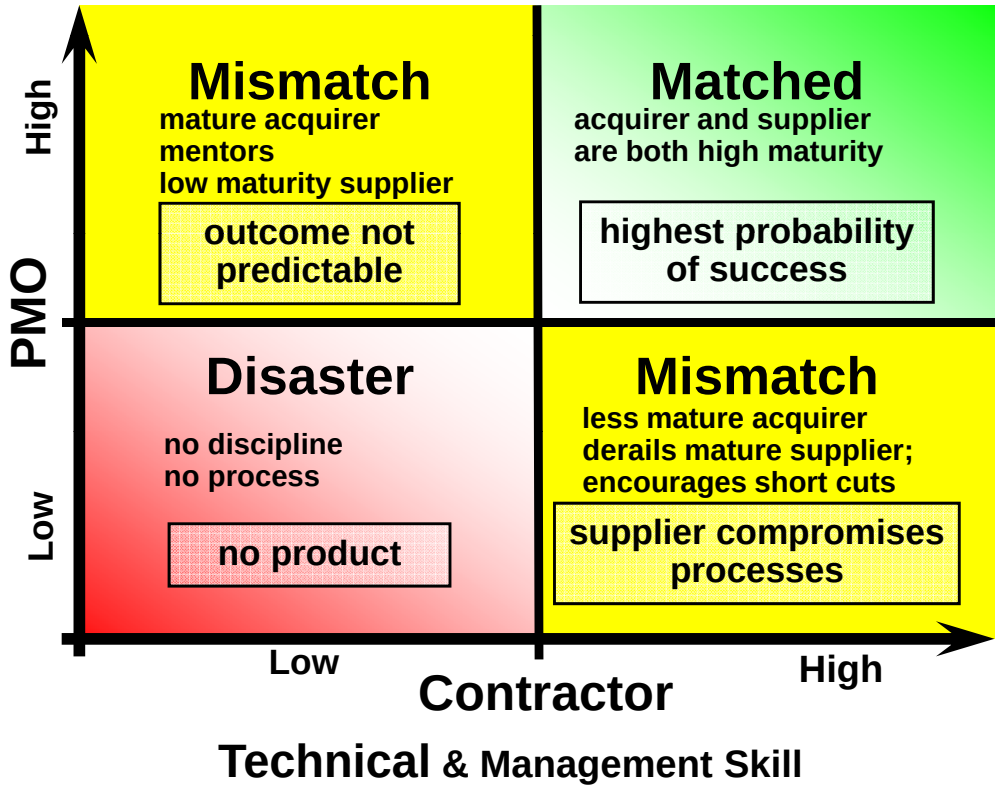
# Acquisition Process Improvement is Needed….

Acquirers cannot ensure that mature processes are applied to their programs




Acquirers need more internal process focus





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# Guidebook Concept

Provide a “process toolbox” for the acquirer

- Include practical guidance on how to recognize the real practitioners…
- Encourage the use of capability and maturity profiles vice "single level" approach
- Improve acquisition organizations' understanding of the meaning of high maturity (levels 4 and 5) and equivalent staging
- Include multiple tools and guidance that may be used throughout the acquisition lifecycle


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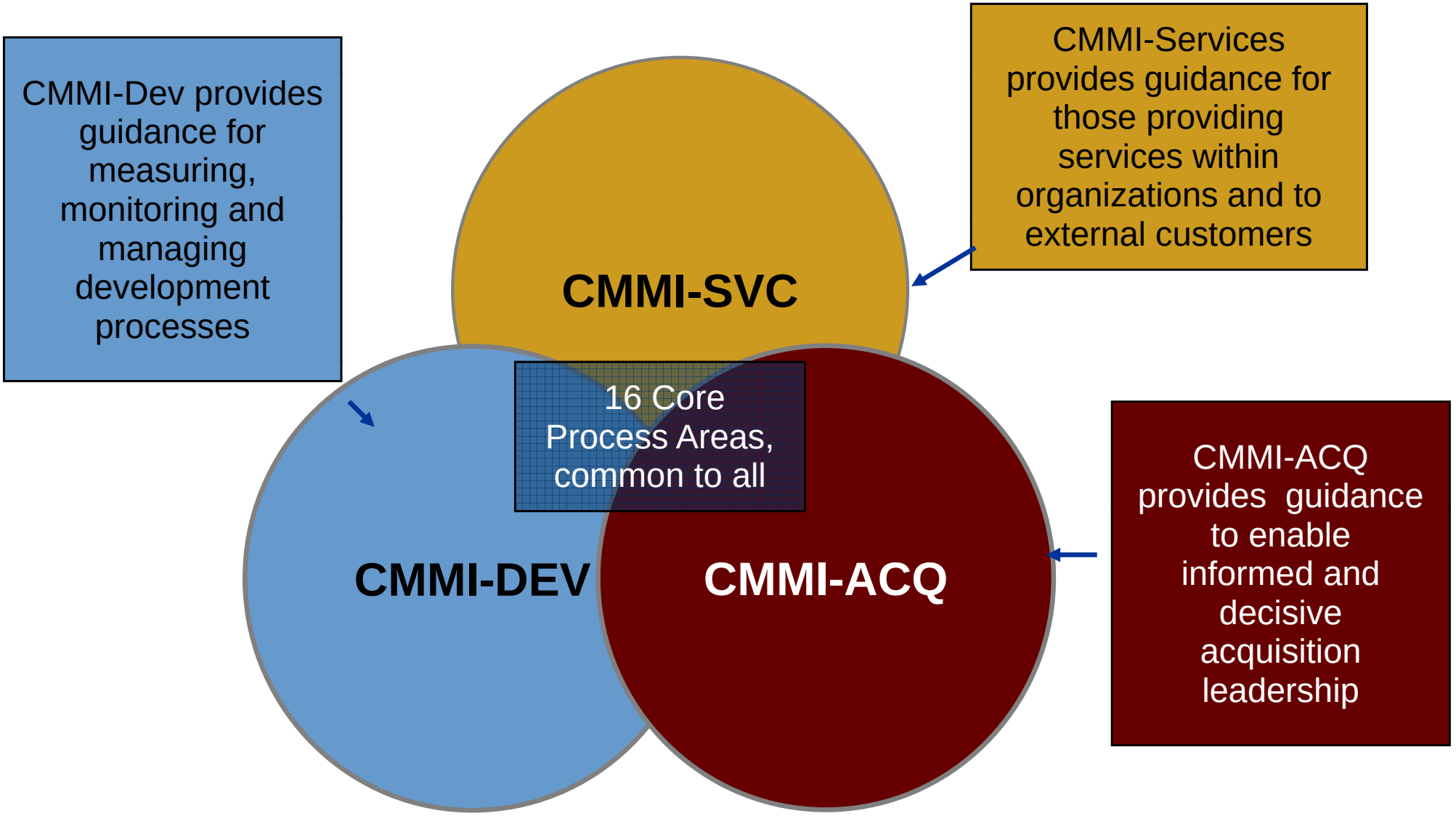
# 3 Complementary “Constellations”





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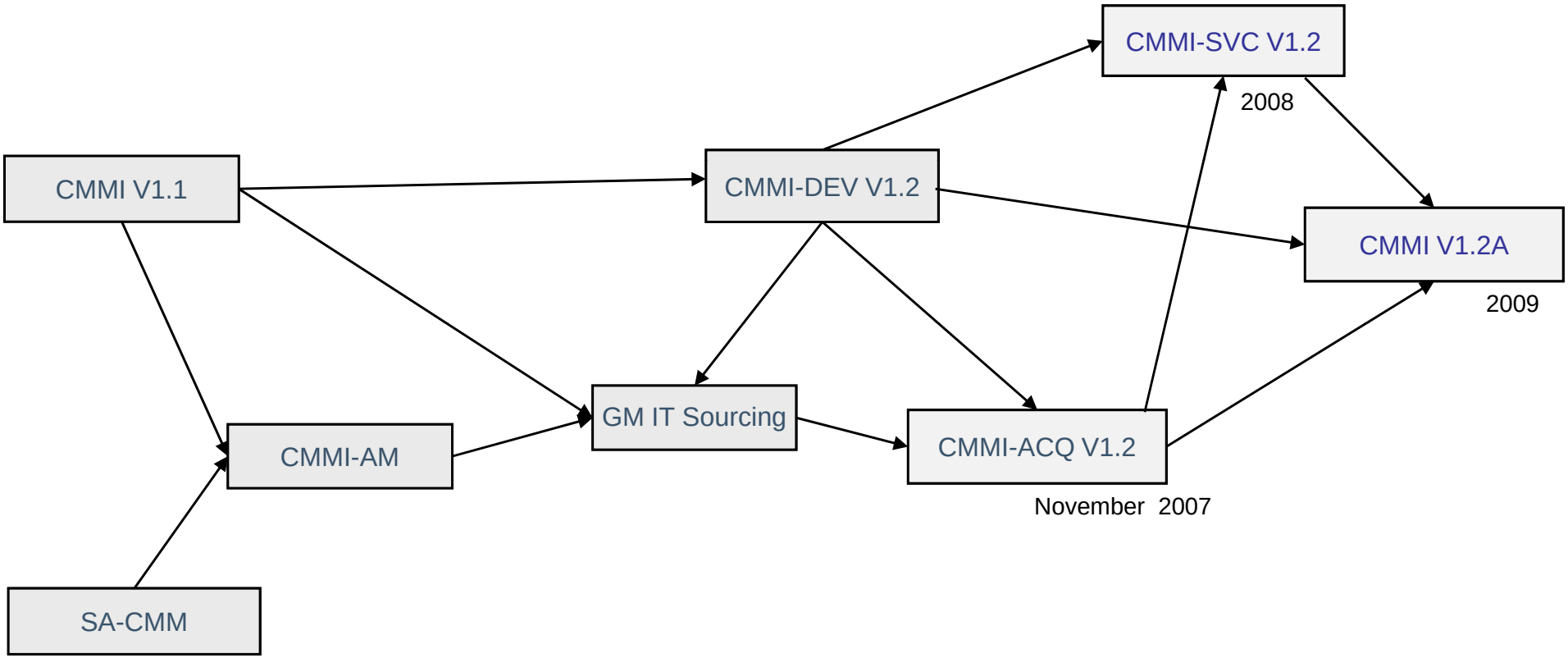
# Planned Sequence of Models





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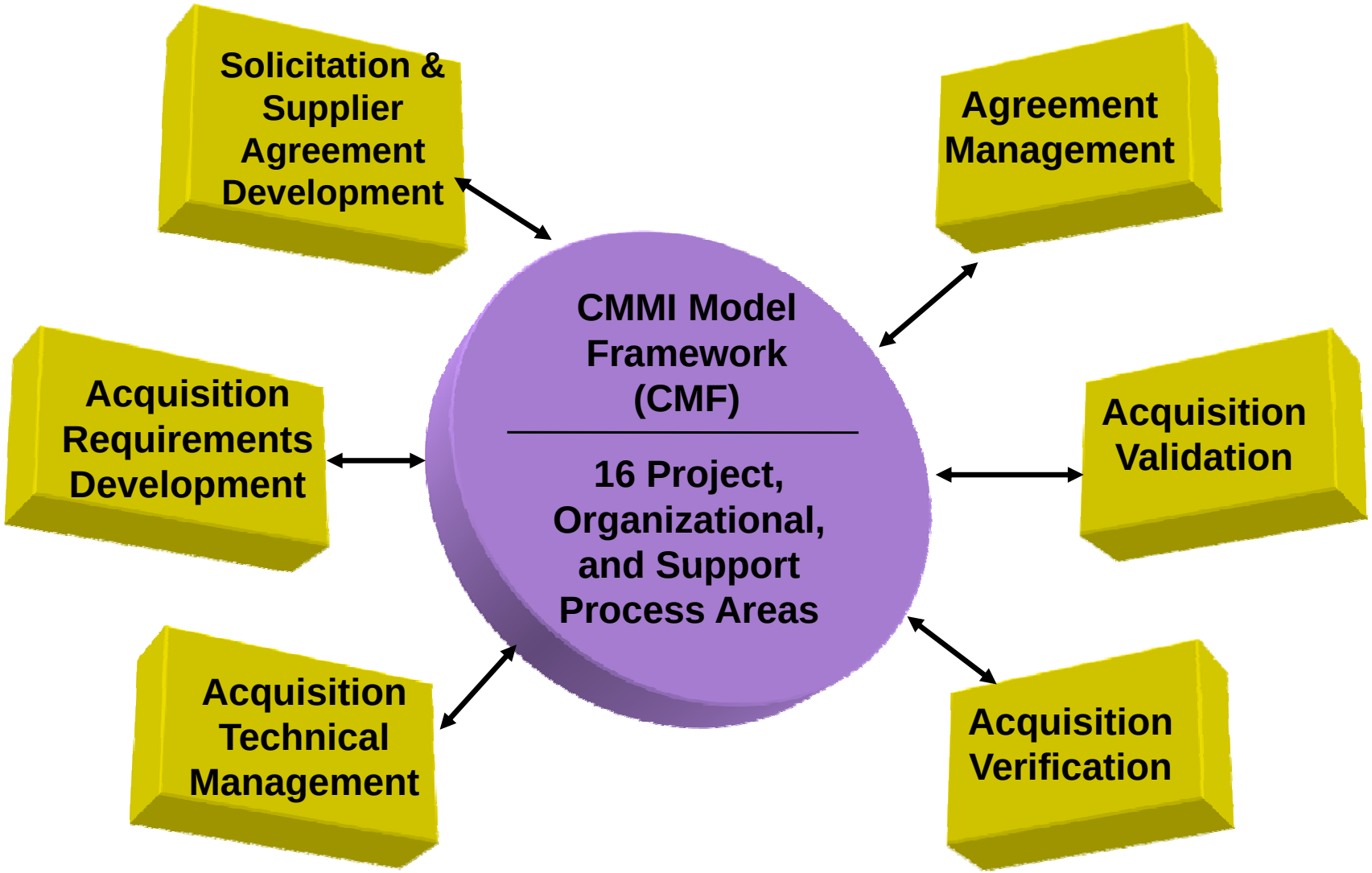
# CMMI-ACQ v1.2
# Acquisition Category Process Areas





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# Staged Representation: PAs by Maturity Level

| Maturity Level | | Process Areas |
|---|---|---|
| 5 | Optimizing | Causal Analysis and Resolution<br>Organizational Innovation and Deployment |
| 4 | Quantitatively Managed | Quantitative Project Management<br>Organizational Process Performance |
| 3 | Defined | Organizational Process Focus<br>Organizational Process Definition<br>Organizational Training<br>Integrated Project Management<br>Risk Management<br>Acquisition Technical Management<br>Acquisition Verification<br>Acquisition Validation<br>Decision Analysis and Resolution |
| 2 | Managed | Acquisition Requirements Development<br>Agreement Management<br>Project Planning<br>Project Monitoring and Control<br>Requirements Management<br>Configuration Management<br>Process and Product Quality Assurance<br>Measurement and Analysis<br>Solicitation and Supplier Agreement Development |


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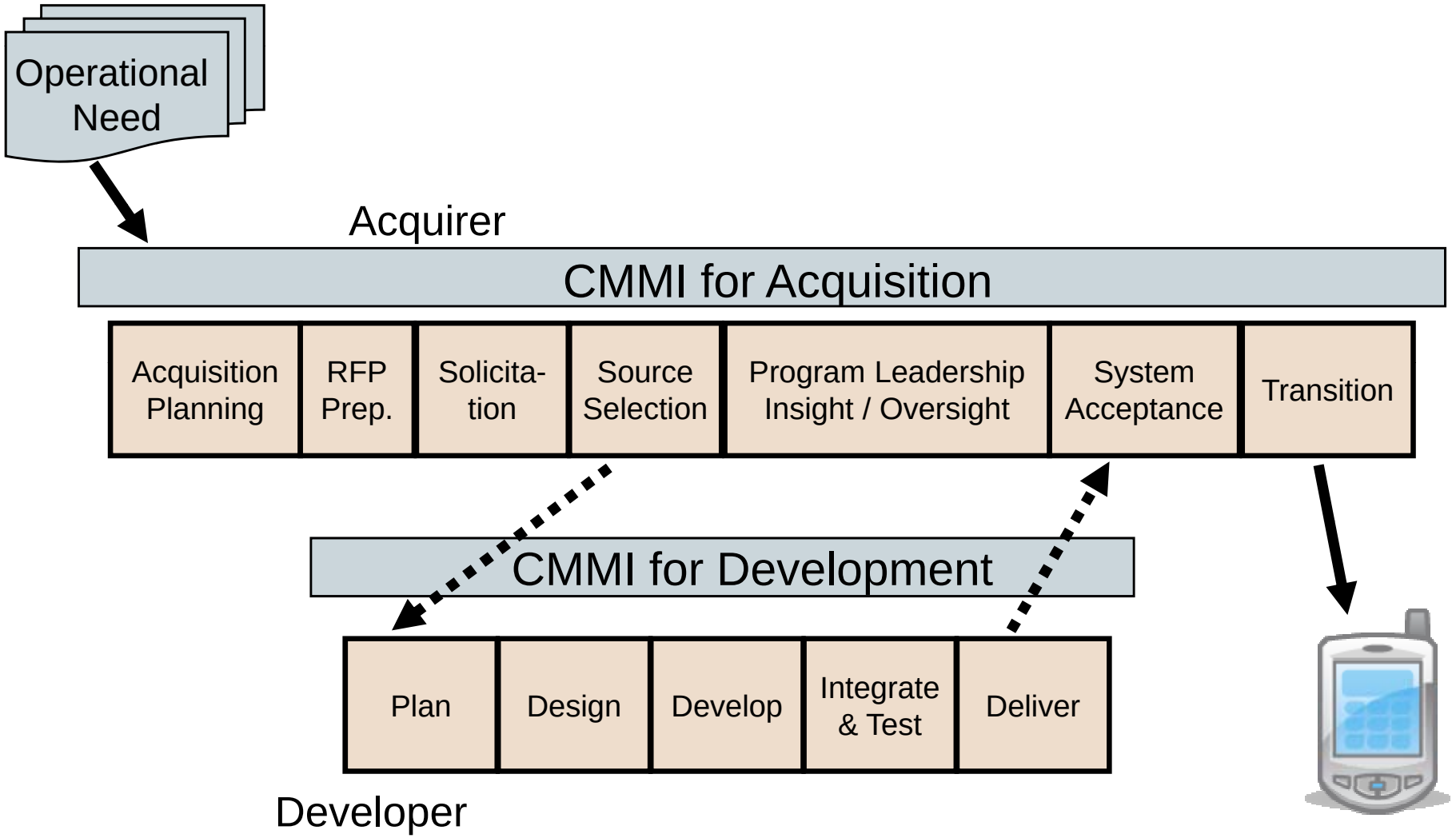
# Visibility into the *Team's* Capability





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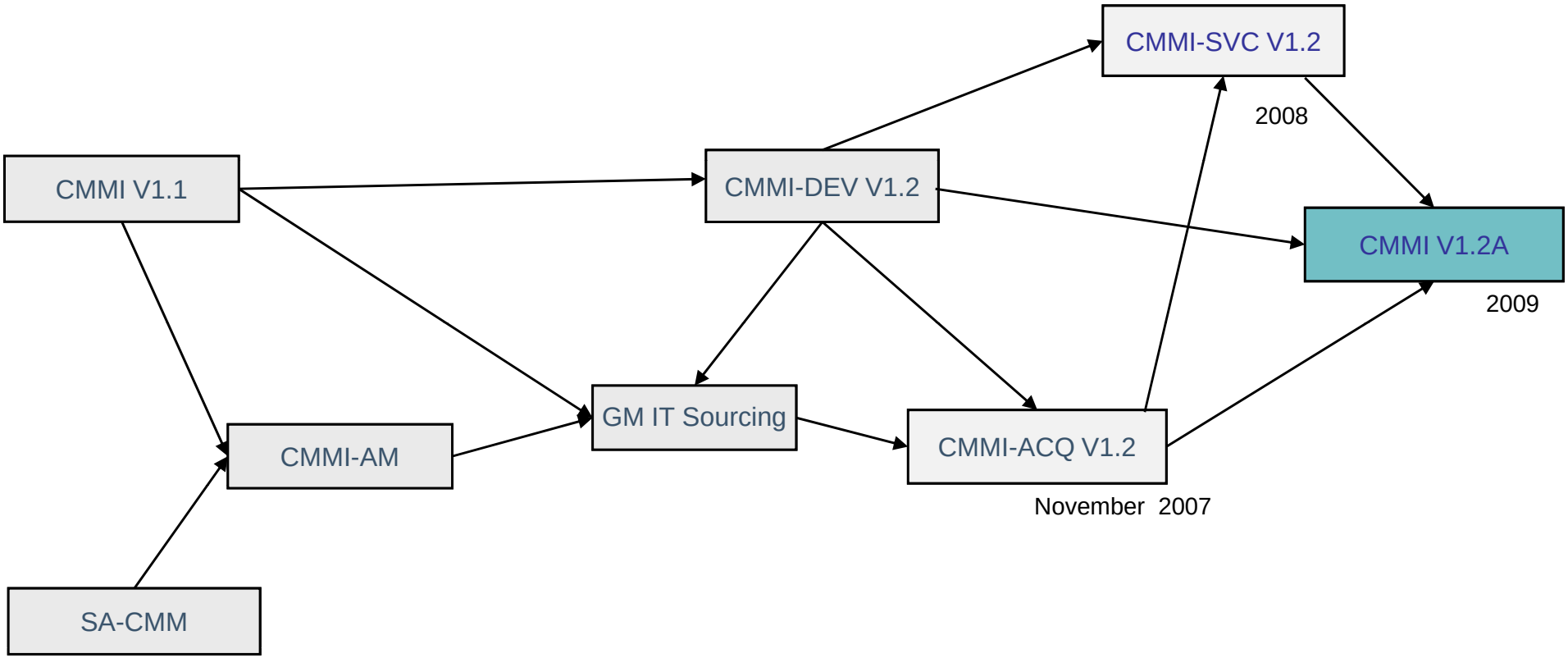
# Planned Sequence of Models





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# Questions to Guide Future Development

How can we "slim down" the CMMI models while still preserving integrity?

Can we likewise "slim down" the Appraisal method?

Can we eliminate the Staged representation?

Is the CMMI v1.2 Constellation Strategy the right approach?

Can we identify "next-generation" process improvement methodologies?

Can CMMI be harmonized with other standards and process improvement efforts?

Can repeatability, consistency and overall model and appraisal methodology be improved?

Are there "breakthrough" concepts that we can apply to overall process improvement?


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# Can CMMI be harmonized with other standards and process improvement efforts?

Agree that harmonization should be a goal, but should not slow progress too much

Harmonization efforts take time

- (This may be the only formal harmonization effort) Currently,15288 being harmonized with 12207 (ongoing several years). There is a move to say “either or”. Recent work in this area to come out soon.

Are there “standards” we want to focus on?

- Standards
- Process Improvement Methods
- 9001, 14000 (environmental standard), AS 9100, FAA Standard (Aviation Critical Safety Items), 15288, 12207, 15504, ITIL, COBIT, Sarbanes-Oxley, 632 (Systems Engineering), 1220, Malcolm Baldridge, Six Sigma [not all standards here are at the same level of abstraction], PM BOK and OPM3


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# Next Steps…

Send us your ideas

- Form available on-line from SEI
- Submit like a Change Request

Open Discussion


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# CMMI V1.2 and Beyond
# The Details


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# Topics

< Model

Appraisals

Training

Related Work

Model Basics

CMMI-ACQ


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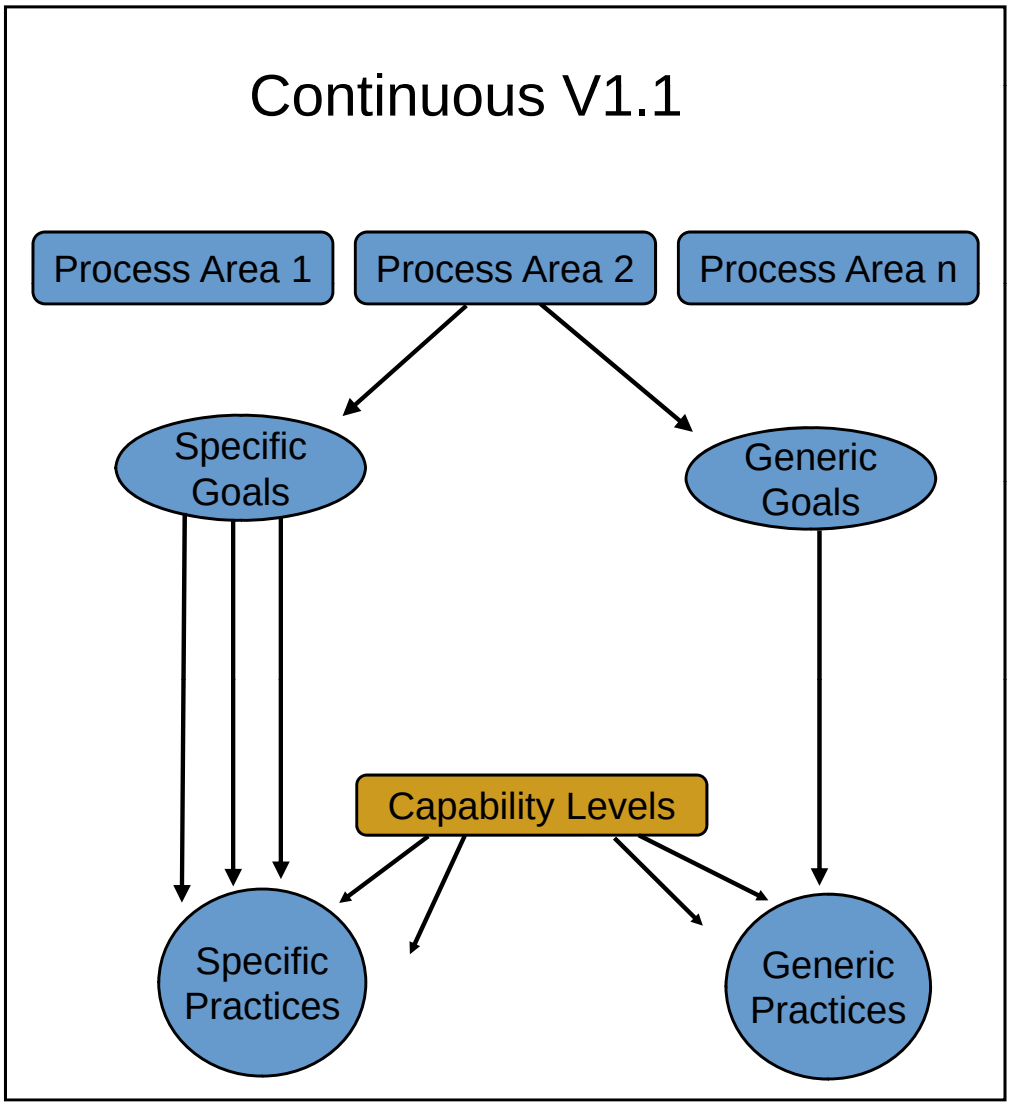
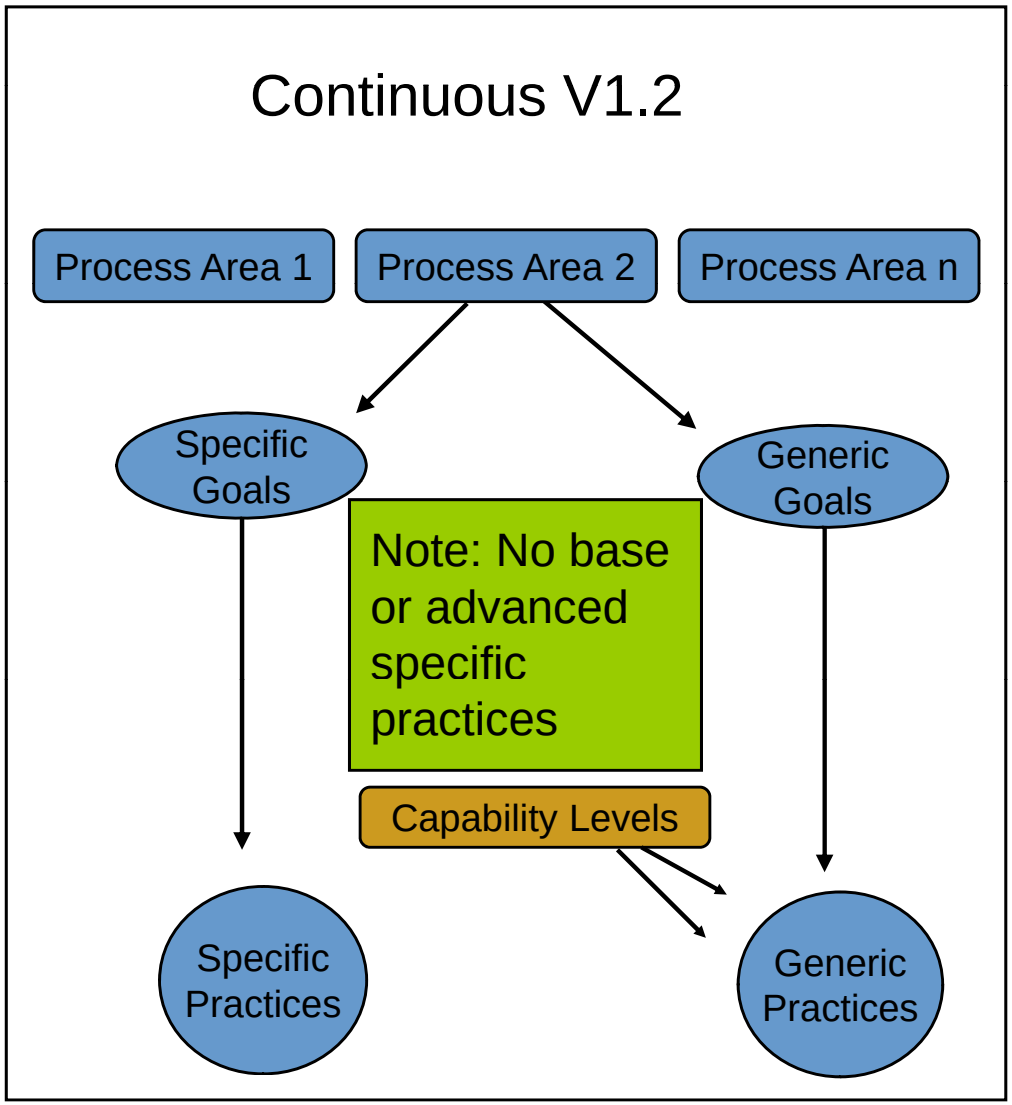
# Model Structure -1





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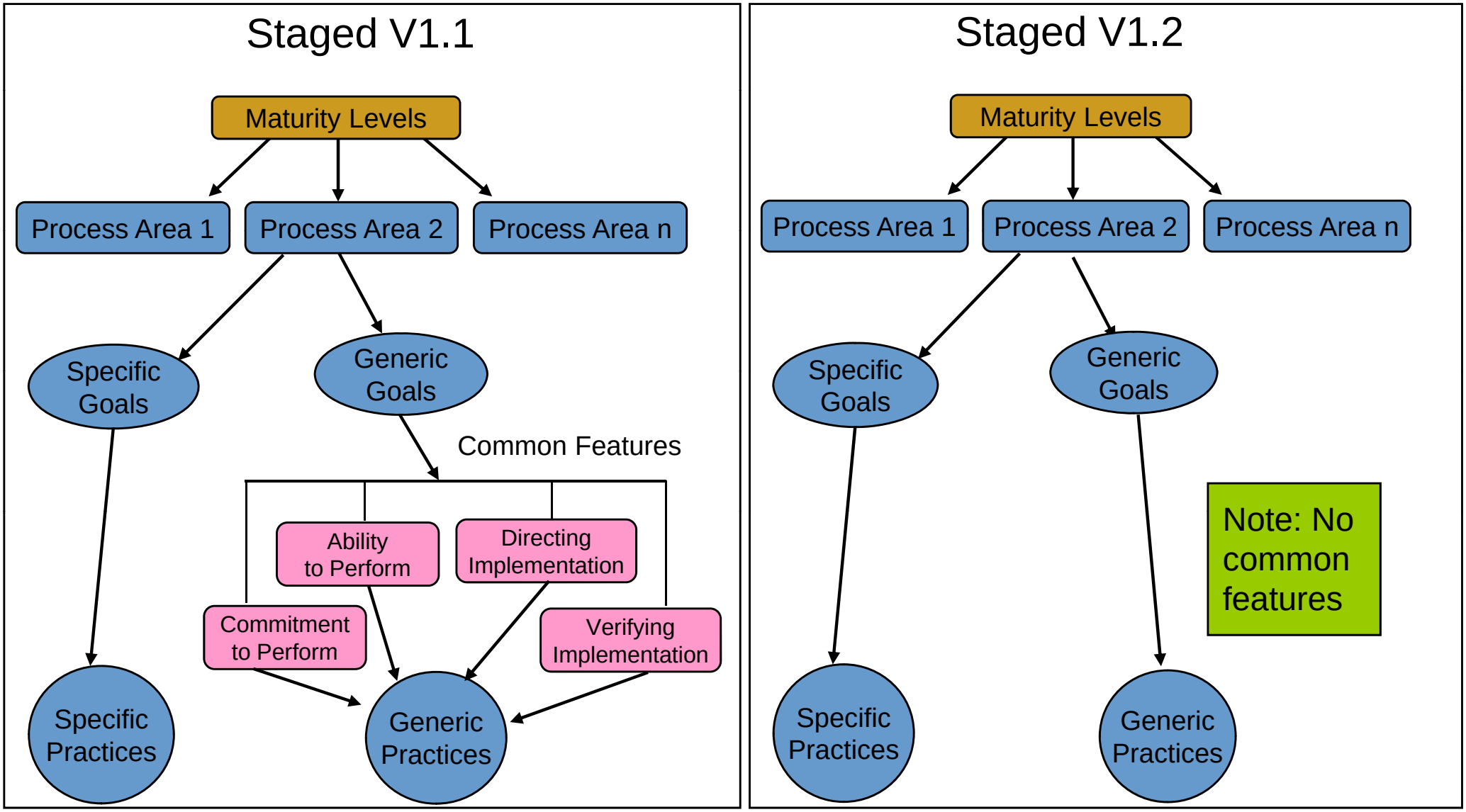
# Model Structure -2





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# The Model Is a Single Document

All representations, additions, and disciplines are in one document.

Users can choose to use the following:

- representation-specific content (i.e., continuous, staged)
- addition-specific content (i.e., IPPD)
- amplifications (i.e., hardware engineering, software engineering, systems engineering)


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# Added Hardware Amplifications and Examples

Six hardware amplifications were created to add emphasis on hardware engineering. Here is an example from TS.

SP 2.1 Design the Product or Product Component

Develop a design for the product or product component.

*For Hardware Engineering*
*Detailed design is focused on product development of electronic, mechanical, electro-optical, and other hardware products and their components. Electrical schematics and interconnection diagrams are developed, mechanical and optical assembly models are generated, and fabrication and assembly processes are developed.*

Hardware examples were also added to emphasize hardware engineering.


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# Added Work Environment Coverage

Work environment standards are established at the organizational level in OPD.

SP 1.6 Establish Work Environment Standards
Establish and maintain work environment standards.

The project's work environment is established at the project level in IPM.

SP 1.3 Establish the Project's Work Environment
Establish and maintain the project's work environment based on the organization's work environment standards.


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# Overview Section Improvements

The following improvements were made to the model overview (i.e., Part One):

- The chapter containing the generic goals and practices was moved to Part Two with the process areas.
- All definitions are consolidated into the glossary.
- Chapters were reordered into a more logical sequence.
- The Preface and Using CMMI Models chapter were rewritten and updated.
- Descriptions were updated to reflect the new CMMI architecture:
  - Added descriptions of constellations and additions
  - Removed descriptions of base and advanced practices and common features


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# Improved Generic Practices -1

Editorial changes were made to the generic practices. These slides highlight the changes that affect the content.

GP 1.1: Perform Specific Practices

The practice title and statement changed from “perform base practices” to “perform specific practices.”

GP 2.2: Plan the Process

The informative material was condensed to be consistent with the other generic practices.

GP 2.4: Assign Responsibility

In the informative material “and authority” was added.


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# Improved Generic Practices -2

GP 2.6: Manage Configurations

In the GP statement, “levels of configuration management” was changed to “levels of control.”

GP 2.9 Objectively Evaluate Adherence

Added informative material to emphasize work products also.

GP 5.2: Correct Root Causes of Problems

Added notes that the focus of this GP is on a quantitatively managed process, though root causes may be found outside of that process.


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# Explained Generic Practices Better

Moved generic goals and practices to Part Two with the process areas so that all normative elements of the model are consolidated in one place

Added information about how process areas support the implementation of generic practices (GPs)

Added GP elaborations for GP 3.2


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# “Not Applicable” Process Areas

The set of PAs evaluated to achieve a maturity level is an important variable when conducting an appraisal. In v1.1 it was not clear which PAs could be considered “not applicable.”

In v1.2, the guidance for appraisals exists in both SCAMPI$^{SM}$ MDD Appendix A and SCAMPI A Appraisal Disclosure Statement (ADS):

- Only SAM can be declared not applicable.
- Decisions on PAs included in the appraisal must be made by the lead appraiser in conjunction with the appraisal sponsor.
- Rationale for declaring SAM to be “not applicable” must be provided in the Appraisal Disclosure Statement.


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# Glossary Changes

The following slides contain significant changes to glossary definitions. Definitions that only had editorial changes are not included.

New definitions: addition, amplification, bidirectional traceability, customer requirement, data, functional configuration audit, hardware engineering, higher level management, physical configuration audit, project startup, and service.

Revised definitions: acquisition, appraisal, appraisal findings, appraisal scope, audit, capability evaluation, configuration audit, customer, data management, establish and maintain, generic goal, objective evidence, process element, product, product component, project, quality- and process-performance objectives, requirements traceability, shared vision, subprocess, traceability, and work product.


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# Definitions Deleted From the Glossary

Deleted definitions: ability to perform, advanced practices, agreement/contract requirements, appraisal tailoring, appraisal team leader, base practices, CMMI model tailoring, commitment to perform, directing implementation, discipline amplification, lead appraiser, process context, solicitation package, strength, verifying implementation, weakness

Many of these definitions were deleted because the term wasn't used in the model or the overall concept was removed.


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# Process Area Improvements -1

Improvements were made to all process areas; some process areas changed more than others. Only the process areas that were changed significantly will be addressed.

Many of these changes were discussed earlier. However, these slides show you significant changes by process area.


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# Process Area Improvements -2

The following process areas were improved significantly:

- Integrated Project Management +IPPD (IPM+IPPD)
- Organizational Process Definition +IPPD (OPD+IPPD)
- Organizational Process Focus (OPF)
- Requirements Management (REQM)
- Requirements Development (RD)
- Supplier Agreement Management (SAM)
- Technical Solution (TS)
- Validation (VAL)
- Verification (VER)


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# Integrated Project Management +IPPD -1

| Specific Goal | Specific Practice |
|---|---|
| Use the Project's Defined Process | 1.1 – Establish the Project's Defined Process |
| | 1.2 – Use Organizational Process Assets for Planning Project Activities |
| | 1.3 – Establish the Project's Work Environment |
| | 1.4 – Integrate Plans |
| | 1.5 – Manage the Project Using the Integrated Plans |
| | 1.6 – Contribute to the Organizational Process Assets |

- Modified SP 1.1 from "Establish and maintain the project's defined process" to "Establish and maintain the project's defined process from project startup through the life of the project."
- Added SP 1.3 "Establish the Project's Work Environment." (This practice is new to CMMI.)


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# Integrated Project Management +IPPD -2

| Specific Goal | Specific Practice |
|---|---|
| Coordinate and Collaborate with Relevant Stakeholders | 2.1 – Manage Stakeholder Involvement<br>2.2 – Manage Dependencies<br>2.3 – Resolve Coordination Issues |
| Apply IPPD Principles | 3.1 – Establish the Project's Shared Vision<br>3.2 – Establish the Integrated Team Structure<br>3.3 – Allocate Requirements to Integrated Teams<br>3.4 – Establish Integrated Teams<br>3.5 – Ensure Collaboration among Interfacing Teams |

- Reduced the IPPD Addition to one goal (SG3 "Apply IPPD Principles") and its practices.
- To emphasize the IPPD Addition, the name of this process area is now "Integrated Project Management +IPPD" or "IPM +IPPD."


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# Organizational Process Definition +IPPD -1

| Specific Goal | Specific Practice |
|---|---|
| Establish Organizational Process Assets | 1.1 – Establish Standard Processes<br>1.2 – Establish Lifecycle Model Descriptions<br>1.3 – Establish Tailoring Criteria and Guidelines<br>1.4 – Establish the Organization's Measurement Repository<br>1.5 – Establish the Organization's Process Asset Library<br>1.6 – Establish Work Environment Standards |

- Added "and work environment standards" to the purpose statement.
- Added SP 1.6 "Establish Work Environment Standards." (This practice is new to CMMI.)


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# Organizational Process Definition +IPPD -2

| Specific Goal | Specific Practice |
|---|---|
| Enable IPPD Management | 2.1 – Establish Empowerment Mechanisms |
| | 2.2 – Establish Rules and Guidelines for Integrated Teams |
| | 2.3 – Balance Team and Home Organization Responsibilities |

- Added an IPPD Addition to OPD (SG2 “Enable IPPD Management” and its practices).
- To emphasize the IPPD Addition, the name the process area is now “Organizational Process Definition +IPPD” or “OPD +IPPD.”


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# Organizational Process Focus -1

| Specific Goal | Specific Practice |
|---|---|
| Determine Process Improvement Opportunities | 1.1 – Establish Organizational Process Needs<br>1.2 – Appraise the Organization's Processes<br>1.3 – Identify the Organization's Process Improvements |

- Modified the purpose statement to emphasize deployment.
- SP 1.2 "Appraise the organization's processes periodically and as needed to maintain an understanding of their strengths and weaknesses." uses "organization's processes" instead of "processes of the organization."


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# Organizational Process Focus -2

| Specific Goal | Specific Practice |
|---|---|
| Plan and Implement Process Improvements | 2.1 – Establish Process Action Plans<br>2.2 – Implement Process Action Plans |

- Modified SG2 from “Plan and Implement Process Improvement Activities” to “Plan and Implement Process Improvements.”
- Moved to a new SG3 and modified what were SP 2.3 and SP 2.4 in v1.1.


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# Organizational Process Focus -3

| Specific Goal | Specific Practice |
|---|---|
| Deploy Organizational Process Assets and Incorporate Lessons Learned | 3.1 – Deploy Organizational Process Assets<br>3.2 – Deploy Standard Processes<br>3.3 – Monitor Implementation<br>3.4 – Incorporate Process-Related Experiences into the Organizational Process Assets |

- Added new SG3, “Deploy Organizational Process Assets and Incorporate Lessons Learned.”
- Moved what were SP 2.3 and SP 2.4 in v1.1 to the new SG3 as SP 3.1 and SP 3.4.
- Added two new SPs: SP 3.2 “Deploy Standard Processes,” and SP 3.3 “Monitor Implementation.”


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# Requirements Management

| Specific Goal | Specific Practice |
|---|---|
| Manage Requirements | 1.1 – Obtain an Understanding of Requirements<br>1.2 – Obtain Commitment to Requirements<br>1.3 – Manage Requirements Changes<br>1.4 – Maintain Bidirectional Traceability of Requirements<br>1.5 – Identify Inconsistencies Between Project Work and Requirements |

- V1.2 REQM SP 1.4 practice statement now reads, “Maintain bidirectional traceability among the requirements and work products.”
- Project plans are no longer mentioned in this SP statement.
- The description of bidirectional traceability is improved as is its definition in the glossary.


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# Requirements Development -1

| Specific Goal | Specific Practice |
|---|---|
| Develop Customer Requirements | 1.1 – Elicit Needs<br>1.2 – Develop the Customer Requirements |
| Develop Product Requirements | 2.1 – Establish Product and Product Component Requirements<br>2.2 – Allocate Product Component Requirements<br>2.3 – Identify Interface Requirements |

- Former base practice “Collect Stakeholder Needs” is eliminated and former advanced practice, “Elicit Needs” is kept.
- Informative text is added to the introductory notes about applying RD to maintenance projects.


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# Requirements Development -2

| Specific Goal | Specific Practice |
|---|---|
| Analyze and Validate Requirements | 3.1 – Establish Operational Concepts and Scenarios<br>3.2 – Establish a Definition of Required Functionality<br>3.3 – Analyze Requirements<br>3.4 – Analyze Requirements to Achieve Balance<br>3.5 – Validate Requirements |

- Material from V1.1 TS SP 1.2, “Evolve Operational Concepts and Scenarios,” is incorporated into RD SP 3.1.
- Material from V1.1 RD SP 3.5-1, “Validate Requirements,” and RD SP 3.5-2, “Validate Requirements with Comprehensive Methods” were consolidated into a single practice.


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# Supplier Agreement Management

| Specific Goal | Specific Practice |
|---|---|
| Establish Supplier Agreements | 1.1 – Determine Acquisition Type<br>1.2 – Select Suppliers<br>1.3 – Establish Supplier Agreements |
| Satisfy Supplier Agreements | 2.1 – Execute the Supplier Agreement<br>2.2 – Monitor Selected Supplier Processes<br>2.3 – Evaluate Selected Supplier Work Products<br>2.4 – Accept the Acquired Product<br>2.5 – Transition Products |

- V1.1 SAM SP2.1 “Review COTS Products,” was eliminated. “Identify candidate COTS products that satisfy requirements” is a new subpractice under the Technical Solutions Process Area SP1.1, “Develop Alternative Solutions and Selection Criteria.”
- SP2.2 and SP2.3 were added because ISM was eliminated.
- The purpose of SAM was also updated.


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# Technical Solution -1

| Specific Goal | Specific Practice |
|---|---|
| Select Product-Component Solutions | 1.1 – Develop Alternative Solutions and Selection Criteria |
| | 1.2 – Select Product-Component Solutions |

- V1.1 TS SP 1.1-1, “Develop Alternative Solutions and Selection Criteria,” and TS SP 1.1-2, “Develop Detailed Alternative Solutions and Selection Criteria” are consolidated into a single practice.
- “Identify candidate COTS products that satisfy requirements” is a new subpractice under SP1.1.
- V1.1 TS SP 1.2 “Evolve Operational Concepts and Scenarios” is incorporated into RD SP 3.1, “Establish Operational Concepts and Scenarios.”


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# Technical Solution -2

| Specific Goal | Specific Practice |
|---|---|
| Develop the Design | 2.1 – Design the Product or Product Component<br>2.2 – Establish a Technical Data Package<br>2.3 – Design Interfaces Using Criteria<br>2.4 – Perform Make, Buy, or Reuse Analyses |
| Implement the Product Design | 3.1 – Implement the Design<br>3.2 – Develop Product Support Documentation |

- V1.1 TS SP 2.3-1, “Establish Interface Descriptions,” and TS SP 2.3-3, “Design Interfaces Using Criteria” are consolidated into a single practice.


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# Validation

| Specific Goal | Specific Practice |
|---|---|
| Prepare for Validation | 1.1 – Select Products for Validation<br>1.2 – Establish the Validation Environment<br>1.3 – Establish Validation Procedures and Criteria |
| Validate Product or Product Components | 2.1 – Perform Validation<br>2.2 – Analyze Validation Results |

- Notes were added to VAL to stress that validation activities are performed incrementally and involve relevant stakeholders.
- The phrase “and identify issues” was deleted from the statement of SP 2.2 “Analyze Validation Results” to maintain parallelism with VER SP 3.2 “Analyze Verification Results.”


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# Verification -1

| Specific Goal | Specific Practice |
|---|---|
| Prepare for Verification | 1.1 – Select Work Products for Verification<br>1.2 – Establish the Verification Environment<br>1.3 – Establish Verification Procedures and Criteria |
| Perform Peer Reviews | 2.1 – Prepare for Peer Reviews<br>2.2 – Conduct Peer Reviews<br>2.3 – Analyze Peer Review Data |

- No changes to SG1, SG2, or their practices.


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# Verification -2

| Specific Goal | Specific Practice |
|---|---|
| Verify Selected Work Products | 3.1 – Perform Verification |
| | 3.2 – Analyze Verification Results |

- The phrase “and identify corrective action” was deleted from both the title and statement of SP 3.2 “Analyze Verification Results. (Corrective action is handled in PMC SG2, “Manage Corrective Action to Closure.)


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# Summary

Many changes were made to the CMMI models to improve quality. The major changes include

- name changed to “CMMI for Development”
- both representations in one document
- amplifications improved; added hardware amplifications
- common features and advanced practices eliminated
- SS addition eliminated; ISM brought into SAM
- guidelines for “not applicable” process areas clarified
- overview and glossary improved
- work environment material added to OPD and IPM
- IPPD material simplified and consolidated
- process deployment strengthened in IPM and OPF


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# SCAMPI A V1.2 Major Themes

Reduce complexity and ambiguity

Provide additional guidance where needed

Strengthen appraisal planning and conduct

Strengthen appraisal reporting

Define appraisal validity period

Strengthen lead appraiser requirements


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# Revision Process

The CMMI Steering Group provided a long-term strategy and the upgrade criteria for v1.2.

The SCAMPI Upgrade Team (SUT) reviewed change requests to identify possible changes for the v1.2 appraisal method documents: Appraisal Requirements for CMMI (ARC) and Method Definition Document (MDD).

The CMMI Steering Group served as the configuration control board for v1.2 changes to the ARC and MDD.

The SUT developed a draft of the ARC and MDD for review by lead appraisers in May 2006.

The ARC and MDD were released as part of the v1.2 CMMI Product Suite.


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# Reduce Complexity -1

The requirement for instruments (e.g., questionnaires) was removed.

Only two types of objective evidence are now required:

- documents
- interviews

The following sections in MDD were revised:

- switched 2.2 Verify and Validate Objective Evidence and 2.3 Document Objective Evidence so that the order of tasks reflects the natural order of conducting an appraisal
- separated Verify Objective Evidence and Validate Preliminary Findings to better describe each process


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# Reduce Complexity -2

The use of the term instantiation was changed:

- Instantiation is now defined as “the implementation of a model practice used in the appropriate context within the boundaries of an organizational unit.”
- The word “instantiation” for project and organizational-wide entities was replaced with “project” or “support group.”


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# Reduce Ambiguity

The rating Not Rated was clarified:

- Process areas outside of the model scope are rated as Out of Scope. For example, for a maturity level 3 appraisal, maturity level 4 and 5 process areas are rated as Out of Scope.
- For process areas that have insufficient data to be rated, the rating is Not Rated.
- Process areas in the model scope, but outside the organizational scope are rated as Not Applicable. The only process area that can be Not Applicable is SAM (as determined by the appraisal team).

The practice characterization tables were revised:

- clarified the use of virtual versus live interviews
- changed “face-to-face interviews” to “oral interviews”


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# Provide Additional Guidance

Guidance for readiness reviews was revised to include team and logistical readiness.

Additional guidance was provided for using virtual methods (e.g., for interviews and briefings).

Additional guidance was provided for using alternative practices (i.e., Appendix C: Alternative Practice Identification and Characterization Guidance).


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# Strengthen Appraisal Planning and Conduct

Organizational unit sampling was revised to*

- strengthen parameters and limits for organizational sampling (e.g., identifying a minimum number of focus projects)
- include additional criteria for reporting sampling decisions

The Conduct Appraisal Phase must now be complete within 90 days.

Appraisal team members are now required to sign final findings.

*Changes to address sampling were extensive. Refer to the MDD for details.


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# Strengthen Appraisal Reporting

The Appraisal Disclosure Statement (ADS) now requires the following information.

Organizational sampling criteria and decisions (e.g., projects included, projects excluded, percentage of organization represented)

Basis for maturity/capability level 4 and 5 appraisal results

- subprocesses statistically managed
- mapping of these subprocesses to quality and process-performance objectives

Signatures of both the lead appraiser and sponsor

- The lead appraiser affirms that the appraisal scope is representative of the organizational unit.
- The sponsor affirms the accuracy of the ADS and authorizes the SEI to conduct any audits deemed necessary.


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# Define Appraisal Validity Period

V1.2 appraisal results are valid for a maximum of 3 years from the date of the ADS.

V1.1 appraisals will expire on August 31, 2007 or 3 years after the date the appraisal was conducted, whichever is later.


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# Strengthen Lead Appraiser Requirements

Prior to conducting a v1.2 SCAMPI appraisal, the following must occur:

- Current candidate and authorized lead appraisers and team leaders must complete CMMI v1.2 Upgrade Training.
- Candidate and authorized lead appraisers must attend SCAMPI Face-to-Face Training.
- Those who want to conduct v1.2 SCAMPI level 4 or 5 appraisals must be certified. Certification requirements address the following:
  - education, training, and experience in level 4 and 5 concepts
  - completion of an oral exam


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# Summary

The SCAMPI A appraisal method was revised based on change requests received to

- reduce complexity and ambiguity
- provide additional guidance where needed
- strengthen appraisal planning and conduct
- strengthen appraisal reporting
- define the appraisal validity period
- strengthen lead appraiser requirements

The changes are intended to make appraisals more accurate, reliable, and efficient.


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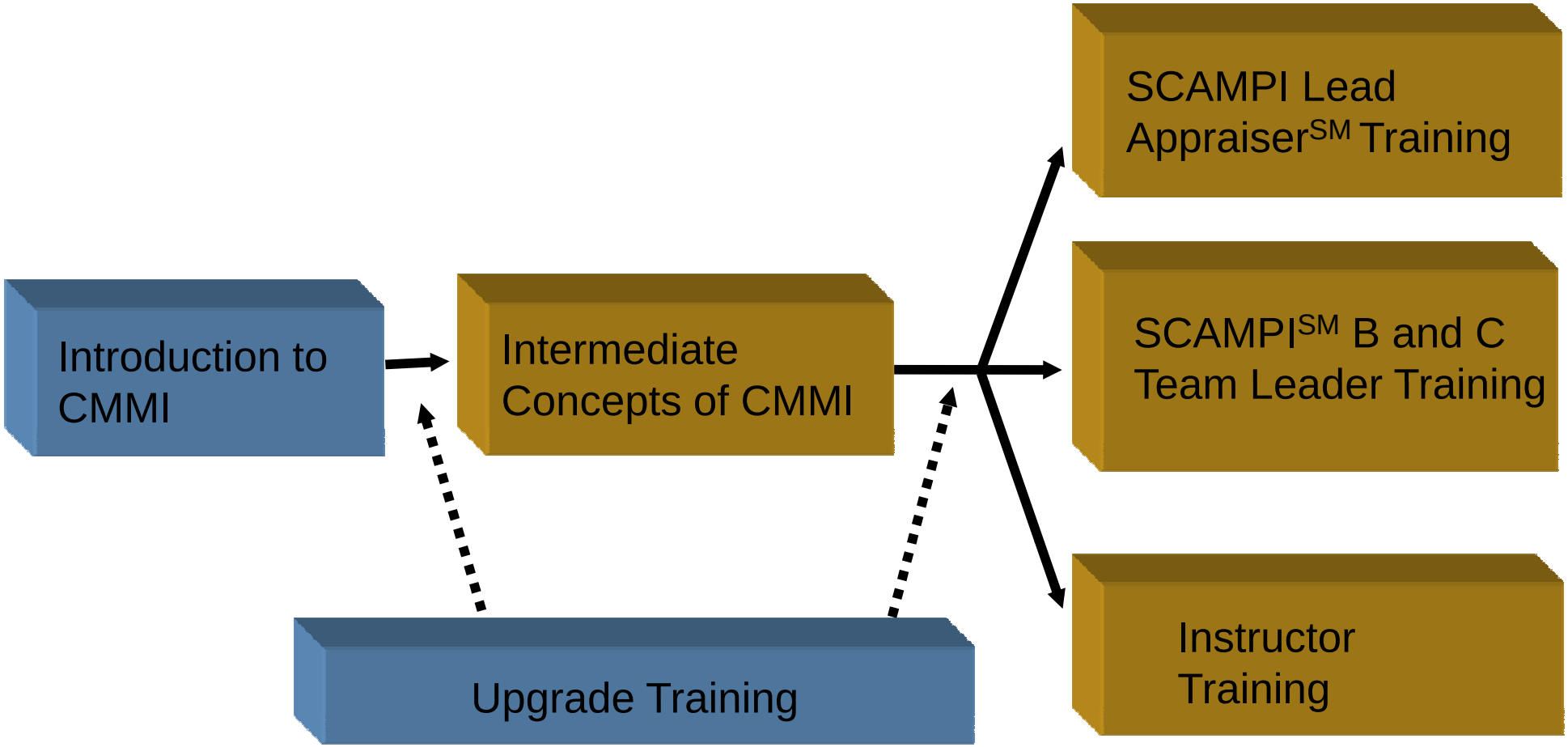
# SEI Training for CMMI





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# CMMI Training Changes

The following courses have all been updated to address change requests and CMMI Product Suite v1.2 changes:

- Introduction to CMMI
- Intermediate Concepts of CMMI
- CMMI Instructor Training
- SCAMPI Lead Appraiser Training
- SCAMPI B and C Team Leader Training

CMMI v1.2 Upgrade Training was also developed to help users move from v1.1 to v1.2, an online course with potential SEI Partner assistance


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# Examinations

The construction and format of examinations have changed. v1.1 tests were largely short answer tests that were the same for all students.

For v1.2, tests will be generated from an item bank and now will be multiple choice. CMMI v1.2 Upgrade Training for Instructors, Lead Appraisers, and Team Leaders is the first course to use this approach. The Intermediate Concepts of CMMI and Instructor Training will follow.


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# Multiple Choice Examinations

This new approach, using an item bank and multiple choice questions, allows multiple versions of examinations that can be constructed more easily:

- The sequence of multiple choice responses can vary from test to test.
- The order of questions can vary from test to test.
- The selection of questions can vary from test to test, but cover the same categories.

This new approach allows the SEI to

- add, modify, and delete questions from the test more easily
- better evaluate the student's knowledge


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# Applying CMMI in Small Settings

Where are we with our work in small settings?

- completed technical feasibility pilots in Huntsville, Alabama with two small companies in the US Army supply chain
- posted the toolkit from this pilot for review:
  - http://www.sei.cmu.edu/ttp/publications/toolkit
- chartered a project to further research in and evolve guidance for CMMI in Small Settings (CSS)

Where are we going?

- International Research Workshop for Process Improvement in Small Settings held October 19-20, 2005
- call for Interest in CSS project is posted on SEI web:
  - http://www.sei.cmu.edu/cmmi/acss/participation.html


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# But what about the rest of the model?

Some may wish a refresher

Others may need the basics, as well as the changes

These next charts attempt to fill the gaps….


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# Topics

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# Critical Distinctions Among Processes

| | | |
|---|---|---|
| performed | vs. | managed |

the extent to which the process is planned; performance is managed against the plan; corrective actions are taken when needed

| | | |
|---|---|---|
| managed | vs. | defined |

the scope of application of the process descriptions, standards, and procedures (i.e., project vs. organization)

| | | |
|---|---|---|
| defined | vs. | quantitatively managed |

the predictability of process performance

| | | |
|---|---|---|
| quantitatively managed | vs. | optimizing |

whether the process is continually improved by addressing common causes of process variation


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# Summary of Generic Goals and Practices

| *Generic Goals* | *Generic Practices* |
|---|---|
| GG1: Achieve Specific Goals | GP 1.1: Perform Specific Practices |
| GG2: Institutionalize a Managed Process | GP 2.1: Establish an Organizational Policy<br>GP 2.2: Plan the Process<br>GP 2.3: Provide Resources<br>GP 2.4: Assign Responsibility<br>GP 2.5: Train People<br>GP 2.6: Manage Configurations<br>GP 2.7: Identify and Involve Relevant Stakeholders<br>GP 2.8: Monitor and Control the Process<br>GP 2.9: Objectively Evaluate Adherence<br>GP 2.10: Review Status with Higher Level Management |
| GG3: Institutionalize a Defined Process | GP 3.1: Establish a Defined Process<br>GP 3.2: Collect Improvement Information |
| GG4: Institutionalize a Quantitatively Managed Process | GP 4.1: Establish Quantitative Objectives for the Process<br>GP 4.2: Stabilize Subprocess Performance |
| GG5: Institutionalize an Optimizing Process | GP 5.1: Ensure Continuous Process Improvement<br>GP 5.2: Correct Root Causes of Problems |

Adapted from Cepeda Systems & Software Analysis, Inc.


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# Continuous Representation: PAs by Categories

| Category | Process Areas |
|---|---|
| Process Management | Organizational Process Focus<br>Organizational Process Definition +IPPD<br>Organizational Training<br>Organizational Process Performance<br>Organizational Innovation and Deployment |
| Project Management | Project Planning<br>Project Monitoring and Control<br>Supplier Agreement Management<br>Integrated Project Management +IPPD<br>Risk Management<br>Quantitative Project Management |
| Engineering | Requirements Management<br>Requirements Development<br>Technical Solution<br>Product Integration<br>Verification<br>Validation |
| Support | Configuration Management<br>Process and Product Quality Assurance<br>Measurement and Analysis<br>Decision Analysis and Resolution<br>Causal Analysis and Resolution |


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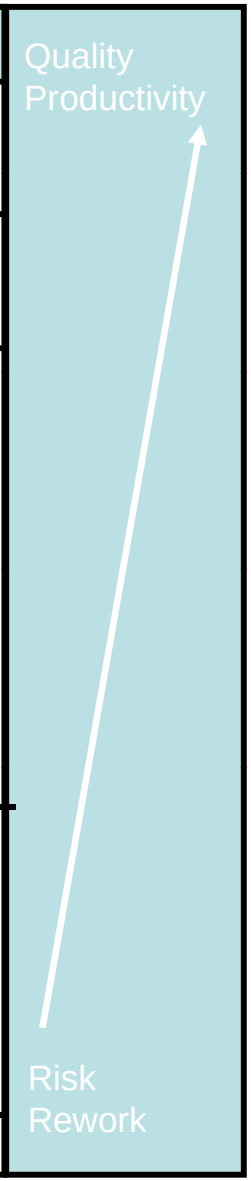
# Staged Representation: PAs by Maturity Level

| Level | Focus | Process Areas |
|---|---|---|
| 5 Optimizing | *Continuous Process Improvement* | Organizational Innovation and Deployment<br>Causal Analysis and Resolution |
| 4 Quantitatively Managed | *Quantitative Management* | Organizational Process Performance<br>Quantitative Project Management |
| 3 Defined | *Process Standardization* | Requirements Development<br>Technical Solution<br>Product Integration<br>Verification<br>Validation<br>Organizational Process Focus<br>Organizational Process Definition +IPPD<br>Organizational Training<br>Integrated Project Management +IPPD<br>Risk Management<br>Decision Analysis and Resolution |
| 2 Managed | *Basic Project Management* | Requirements Management<br>Project Planning<br>Project Monitoring and Control<br>Supplier Agreement Management<br>Measurement and Analysis<br>Process and Product Quality Assurance<br>Configuration Management |
| 1 Initial | | |





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# Understanding Levels

Levels are used in CMMI to describe an evolutionary path for an organization that wants to improve the processes it uses to develop and maintain its products and services.

CMMI supports two improvement paths:

- continuous - enabling an organization to incrementally improve processes corresponding to an individual process area (or set of process areas) selected by the organization
- staged - enabling the organization to improve a set of related processes by incrementally addressing successive predefined sets of process areas


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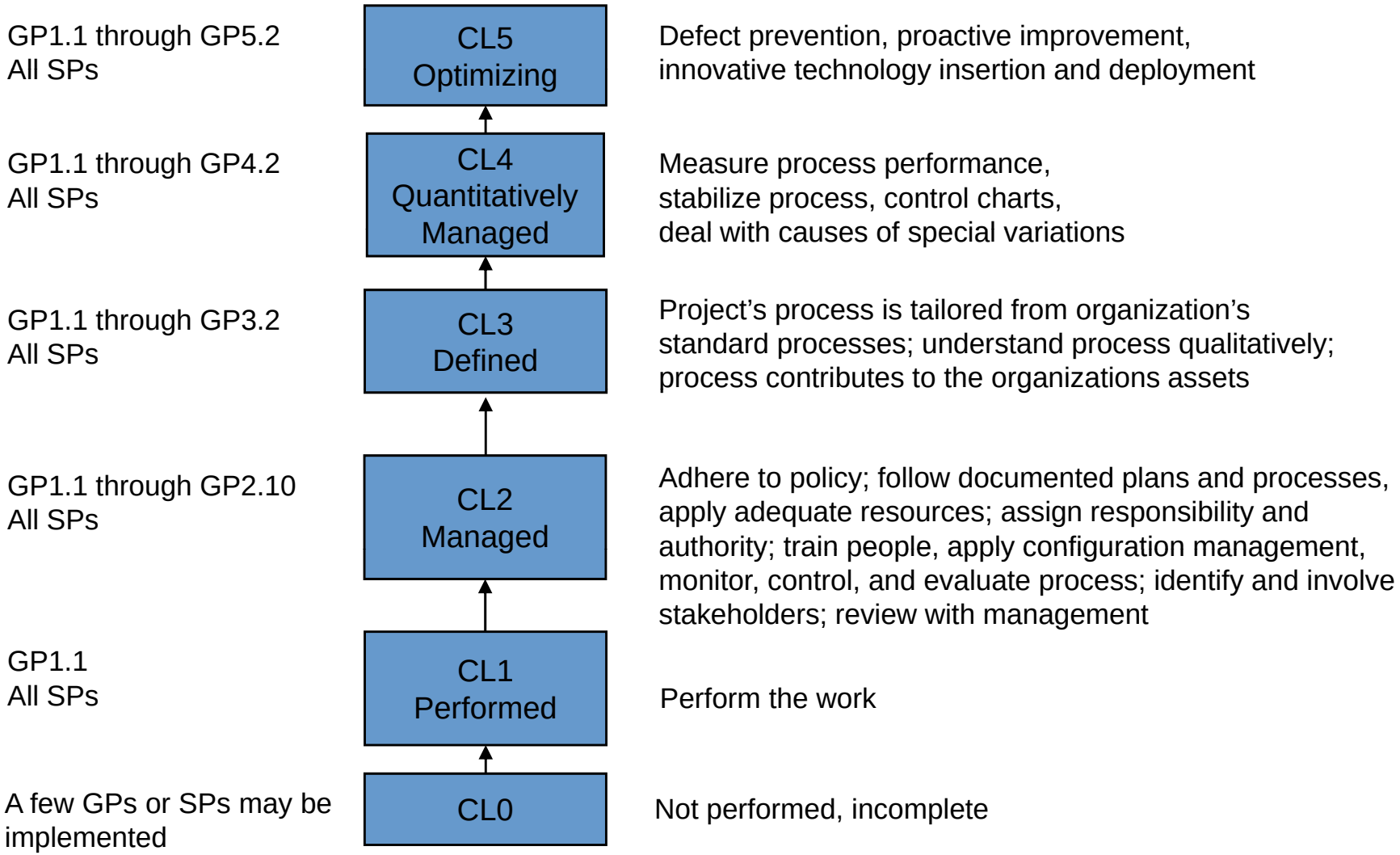
# Achieving Capability Levels (CL) for a Process Area





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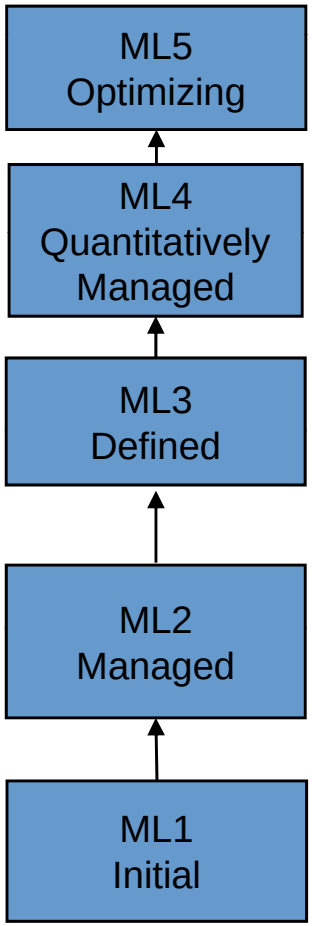
# Achieving Maturity Levels




GP2.1 through GP3.2
All ML2, ML3, ML4, and ML5 PAs

Prevent defects; proactively improve; insert and deploy innovative technology

GP2.1 through GP3.2
All ML2, ML3, and ML4 PAs

Measure process performance; stabilize process and control charts; deal with causes of special variations

GP2.1 through GP3.2
All ML2 and ML3 PAs

Tailor the project's process from organization's standard processes; understand processes qualitatively; ensure that projects contribute to organization assets

GP2.1 through GP2.10
All ML2 PAs

Adhere to policy; follow documented plans and processes; apply adequate resources; assign responsibility and authority; train people; apply CM; monitor, control, and evaluate process; identify and involve stakeholders; review with management

Processes are ad hoc and chaotic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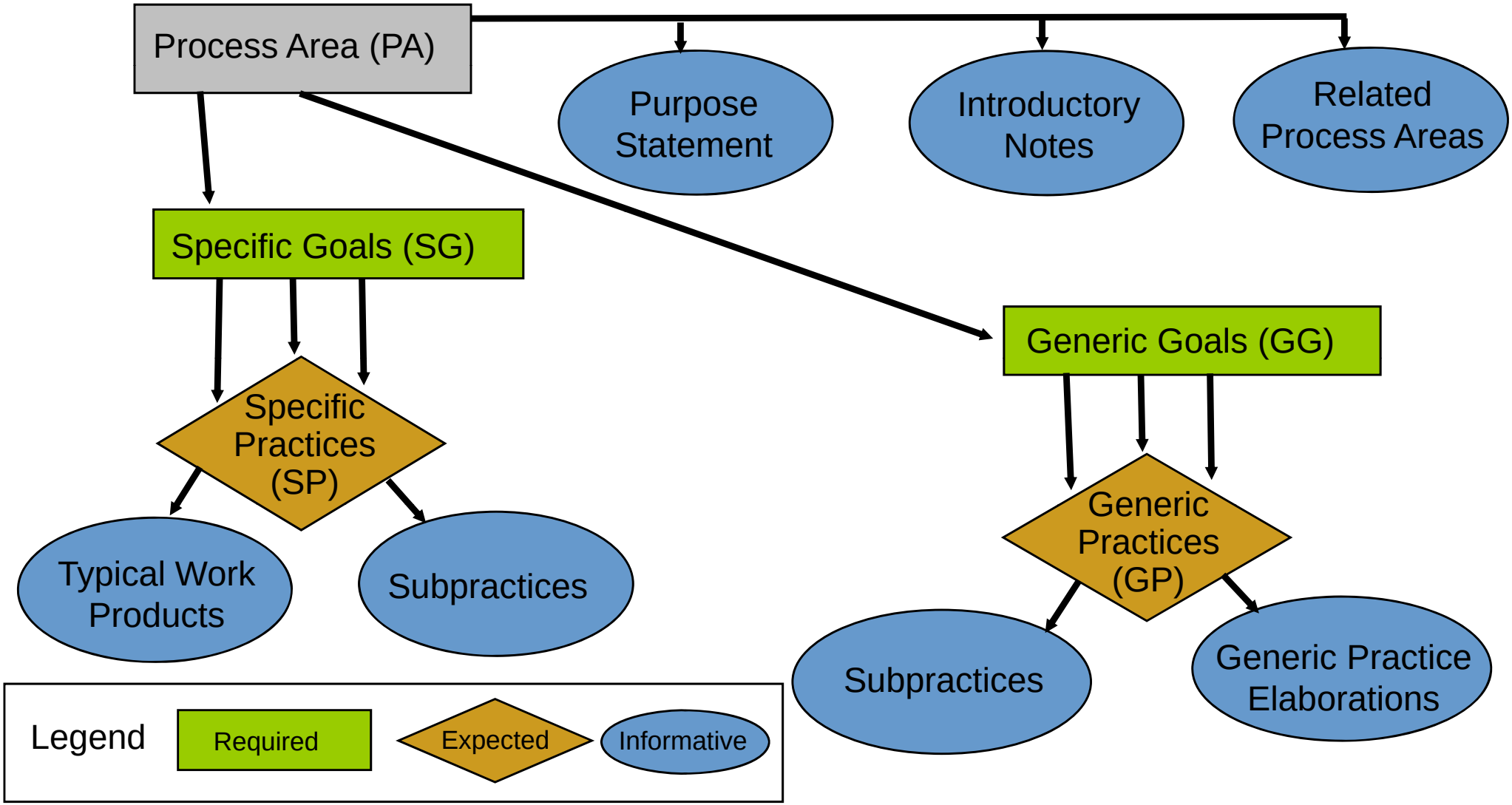
# Process Area Components





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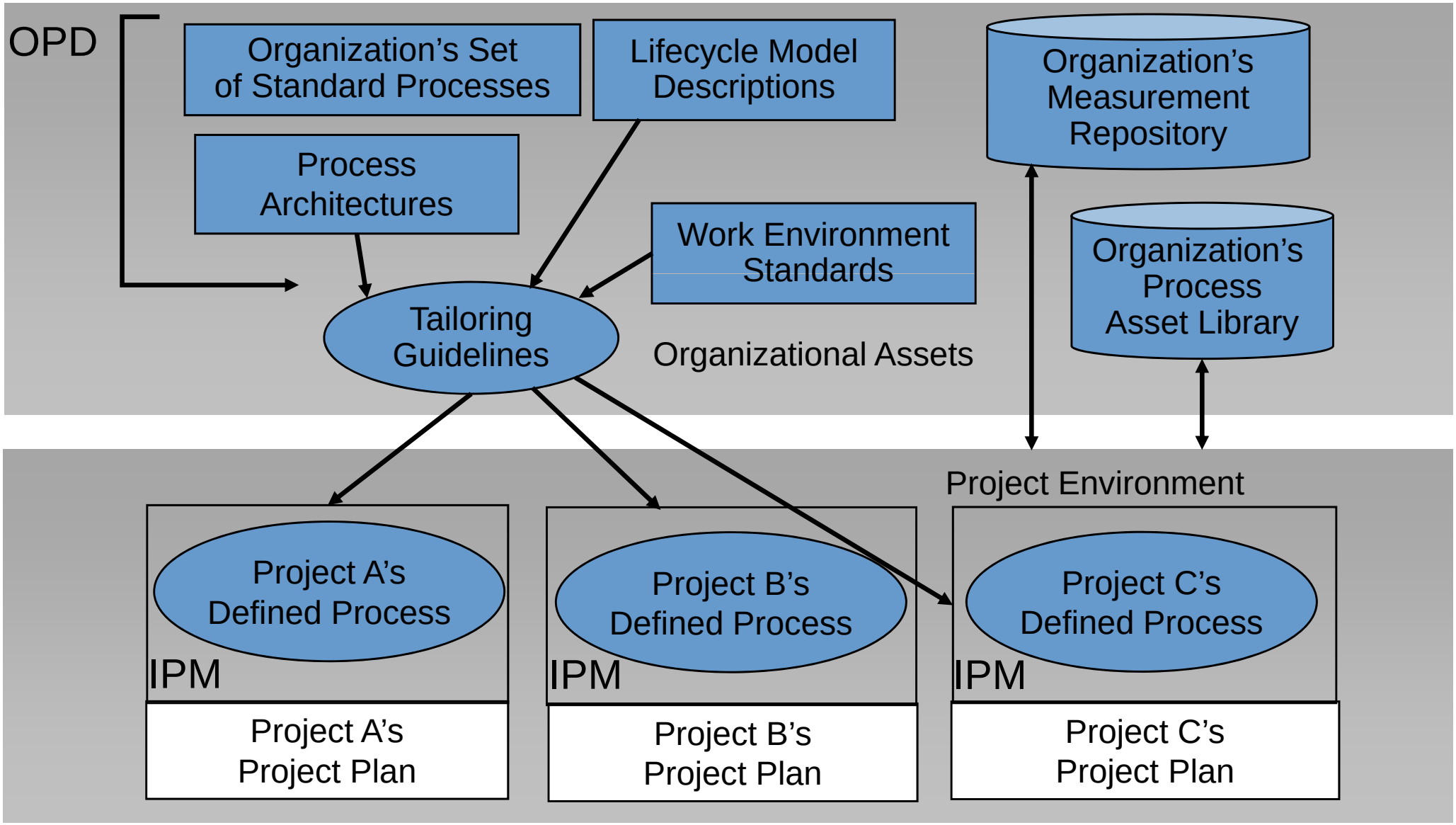
# Interaction Between OPD and IPM





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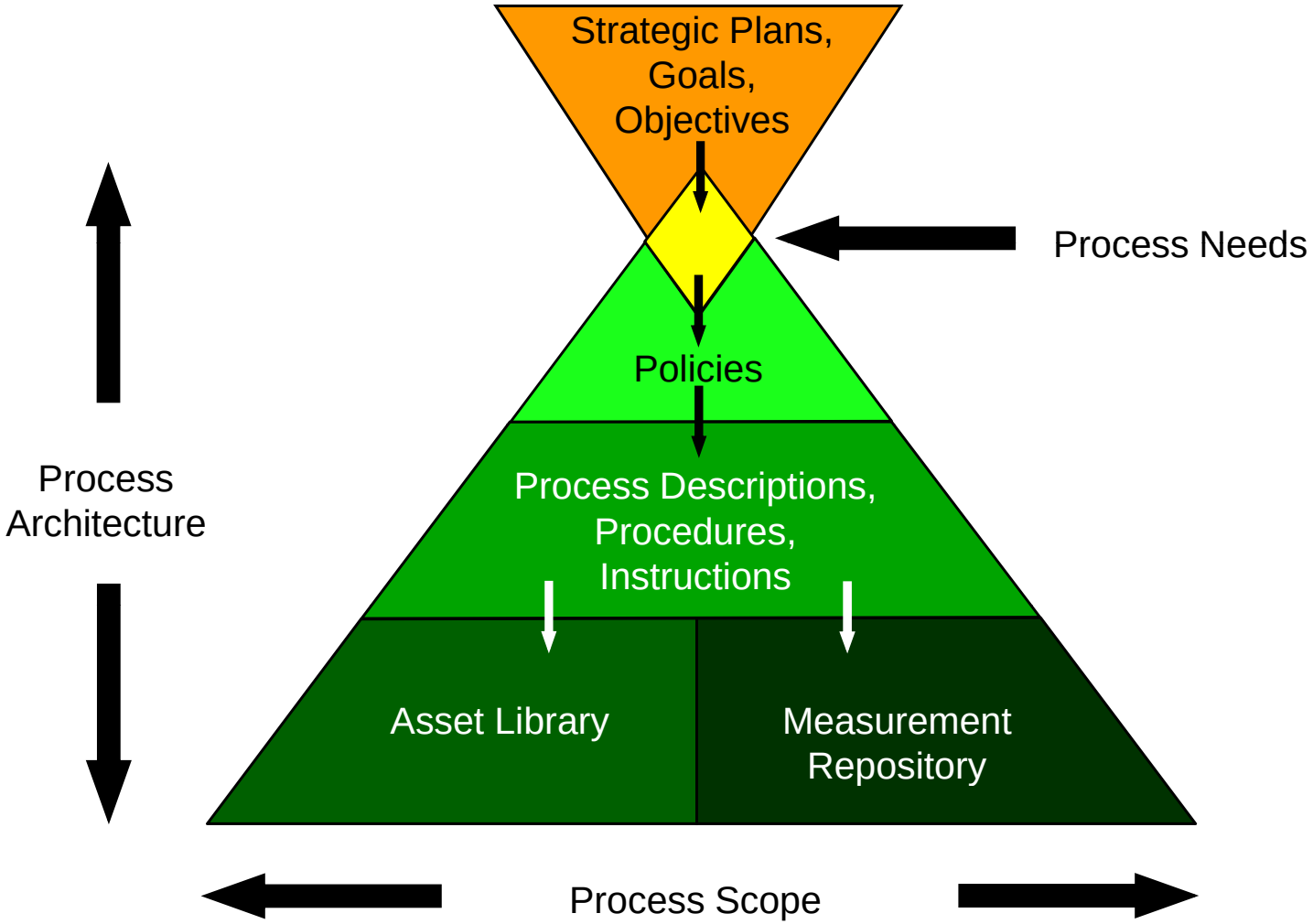
# Process Definition Inputs





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# Causal Analysis and Resolution Goals

SG 1: Determine Causes of Defects

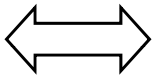
Root causes of defects and other problems are systematically determined.

SG 2: Address Causes of Defects

Root causes of defects and other problems are systematically addressed to prevent their future occurrence.

The process area also has generic goals to support institutionalization.

Note relationship with

- Causal Analysis and Resolution  GP 5.2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# The Other Process Areas

In the earlier segments, we covered the nine Process Areas changed for v1.2:

- IPM, OPD, OPF, RD, REQM, SAM, TS, VAL, VER

Following are the remaining 13 without significant change:

- CAR, CM, DAR, MA, OID, OPP, OT, PI, PMC, PP, PPQA, QPM, RSKM


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# Configuration Management Goals

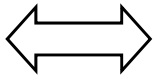
SG 1: Establish Baselines
Baselines of identified work products are established.

SG 2: Track and Control Changes
Changes to the work products under configuration management are tracked and controlled.

SG 3: Establish Integrity
Integrity of baselines is established and maintained.

The process area also has generic goals to support institutionalization.

Note relationship with

- Configuration Management  GP 2.6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# Decision Analysis and Resolution Goals

SG 1: Evaluate Alternatives

Decisions are based on an evaluation of alternatives using established criteria.

The process area also has generic goals to support

institutionalization.


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# Measurement and Analysis Goals

SG 1: Align Measurement and Analysis Activities

Measurement objectives and activities are aligned with identified information needs and objectives.

SG 2: Provide Measurement Results

Measurement results that address identified information needs and objectives are provided.

The process area also has generic goals to support institutionalization.


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# Organizational Innovation and Deployment Goals

## SG 1: Select Improvements

Process and technology improvements that contribute to meeting quality and process-performance objectives are selected.

## SG 2: Deploy Improvements

Measurable improvements to the organization's processes and technologies are continually and systematically deployed.

The process area also has generic goals to support institutionalization.

Note relationship with

- Organizational Innovation and Deployment ⟺ GP 5.1


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# Organizational Process Performance Goals

## SG 1: Establish Performance Baselines and Models

Baselines and models that characterize the expected process performance of the organization's set of standard processes are established and maintained.

The process area also has generic goals to support institutionalization.

Note relationship with

- Organizational Process Performance ⟺ GP 4.1


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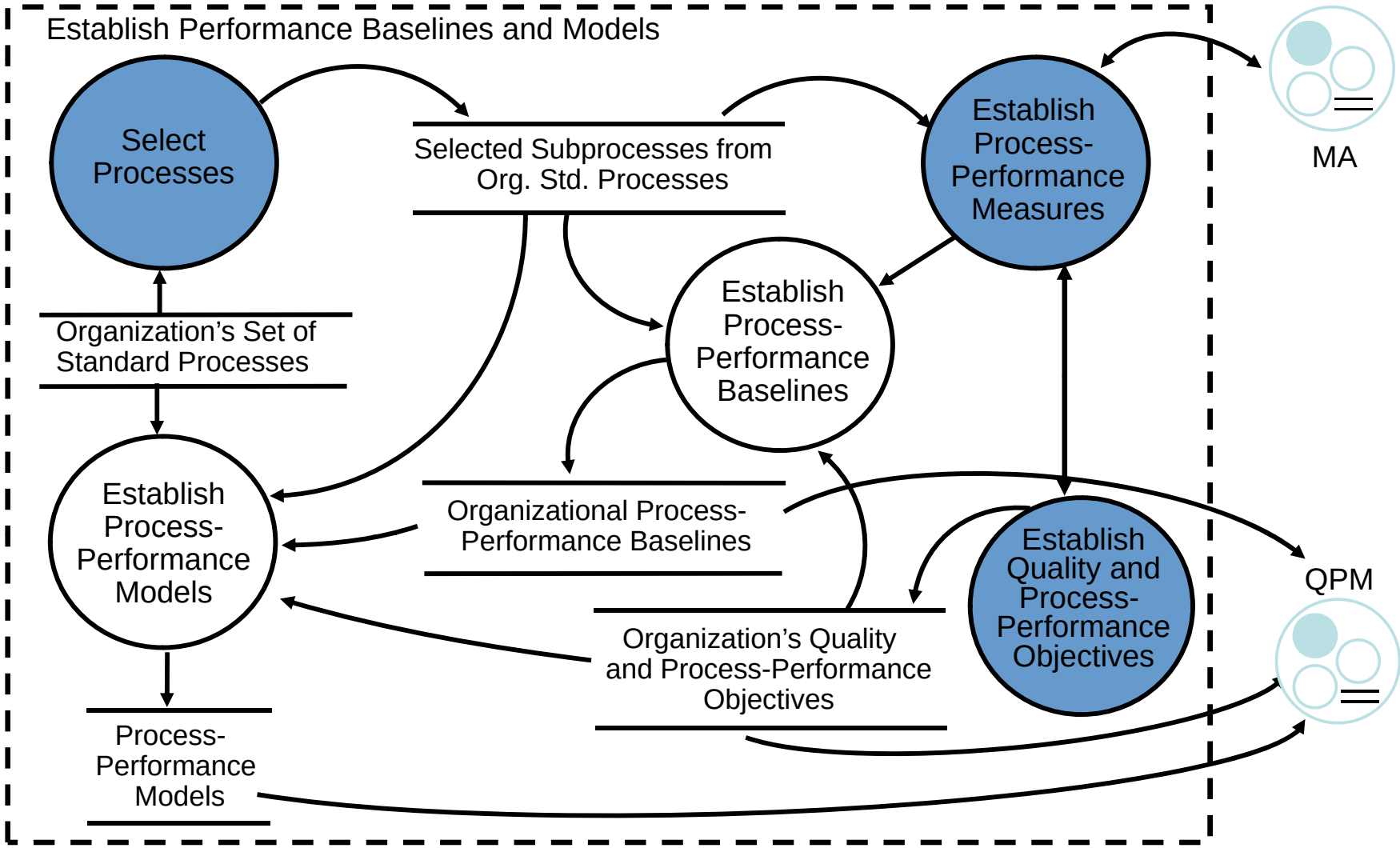
# OPP Context

The shaded SPs interrelate and may need to be performed iteratively.





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# Organizational Training Goals

## SG 1: Establish an Organizational Training Capability

A training capability that supports the organization's management and technical roles is established and maintained.

## SG 2: Provide Necessary Training

Training necessary for individuals to perform their roles effectively is provided.

The process area also has generic goals to support institutionalization.

Note relationship with

- Organizational Training ⟺ GP 2.5


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# Product Integration Goals

SG 1: Prepare for Product Integration
Preparation for product integration is conducted.

SG 2: Ensure Interface Compatibility
The product component interfaces, both internal and external, are compatible.

SG 3: Assemble Product Components and Deliver the Product
Verified product components are assembled and the integrated, verified, and validated product is delivered.

The process area also has generic goals to support institutionalization.


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# Project Monitoring and Control Goals

SG 1: Monitor Project Against Plan

Actual performance and progress of the project are monitored against the project plan.

SG 2: Manage Corrective Action to Closure

Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.

The process area also has generic goals to support institutionalization.

Note relationship with

- Project Monitoring and Control ⟺ GP 2.8


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# Project Planning Goals

## SG 1: Establish Estimates

Estimates of project planning parameters are established and maintained.

## SG 2: Develop a Project Plan

A project plan is established and maintained as the basis for managing the project.

## SG 3: Obtain Commitment to the Plan

Commitments to the project plan are established and maintained.

The process area also has generic goals to support institutionalization.

Note relationship with

- Project Planning ⟺ GP 2.2, GP 2.7


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# Process and Product Quality Assurance Goals

SG 1: Objectively Evaluate Processes and Work Products

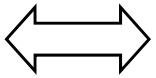
Adherence of the performed process and associated work products and services to applicable process descriptions, standards, and procedures is objectively evaluated.

SG 2: Provide Objective Insight

Noncompliance issues are objectively tracked and communicated, and resolution is ensured.

The process area also has generic goals to support institutionalization.

Note relationship with

- Process and Product Quality Assurance  GP 2.9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# Quantitative Project Management Goals

SG 1: Quantitatively Manage the Project

The project is quantitatively managed using quality and process-performance objectives.

SG 2: Statistically Manage Subprocess Performance

The performance of selected subprocesses within the project's defined process is statistically managed.

The process area also has generic goals to support institutionalization.

Note relationship with

- Quantitative Project Management ⟺ GP 4.1, GP 4.2


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# Risk Management Goals

SG 1: Prepare for Risk Management

Preparation for risk management is conducted.

SG 2: Identify and Analyze Risks

Risks are identified and analyzed to determine their relative importance.

SG 3: Mitigate Risks

Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives.

The process area also has generic goals to support institutionalization.


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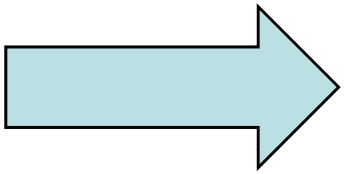
# Addressing market challenges
## *Moving Organizations from Chaos to Discipline*



Random motion – lots of energy, not much progress

No teamwork – individual effort

Frequent conflict

You never know where you'll end up

Directed motion – every step brings you closer to the goal

Coordinated efforts

Cooperation

Predictable results

Processes can make the difference for Developers *and Acquirers*.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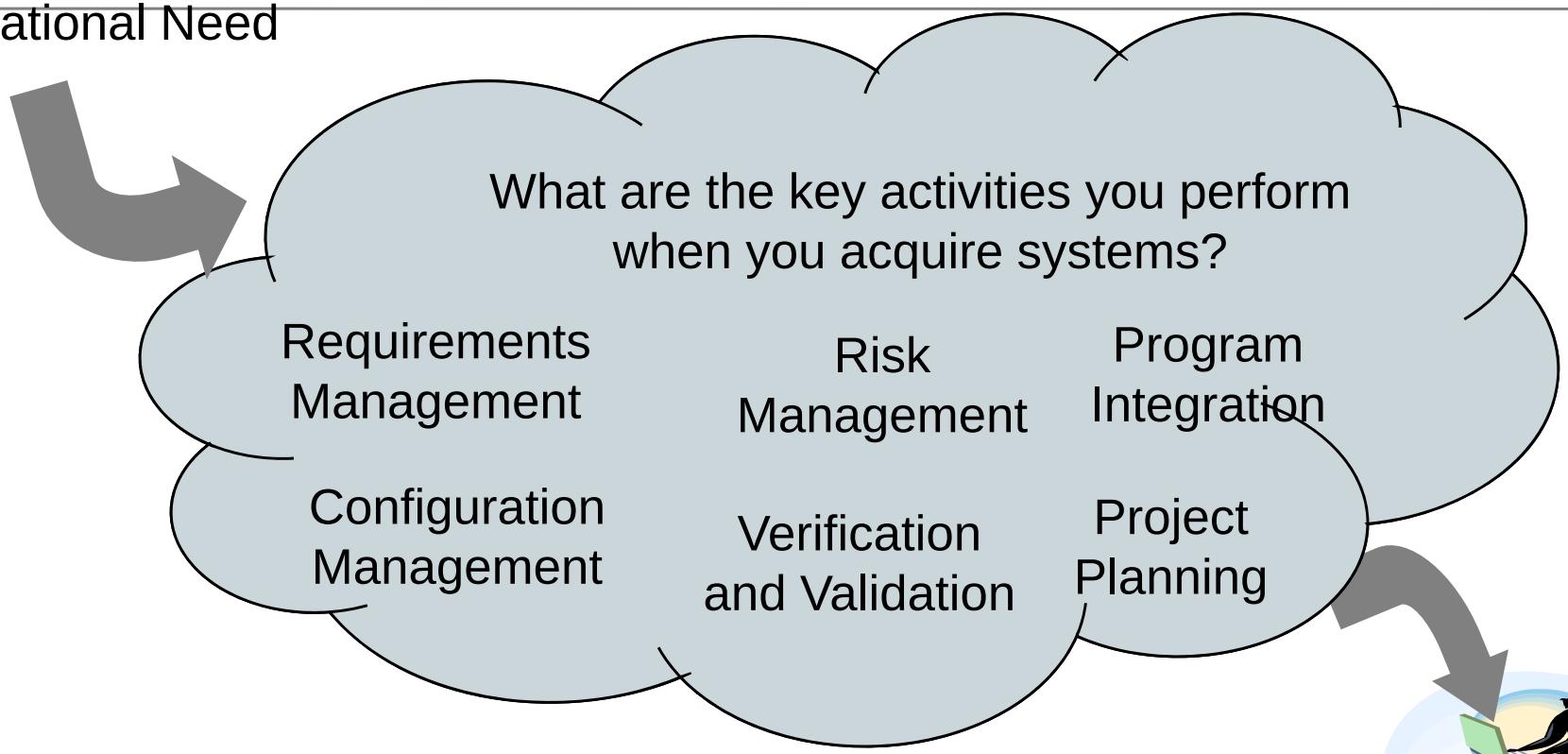
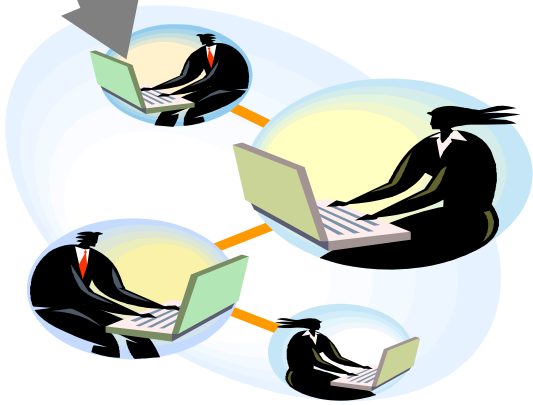
# Inside the Acquirer's Mind

## *What are my capabilities?*

Operational Need



Need to counter these attitudes:

"I'd rather have it wrong than have it late." – Industry senior manager

"Ad hoc, catch as you can…that's our motto."

"We do not work problems until they're unrecoverable."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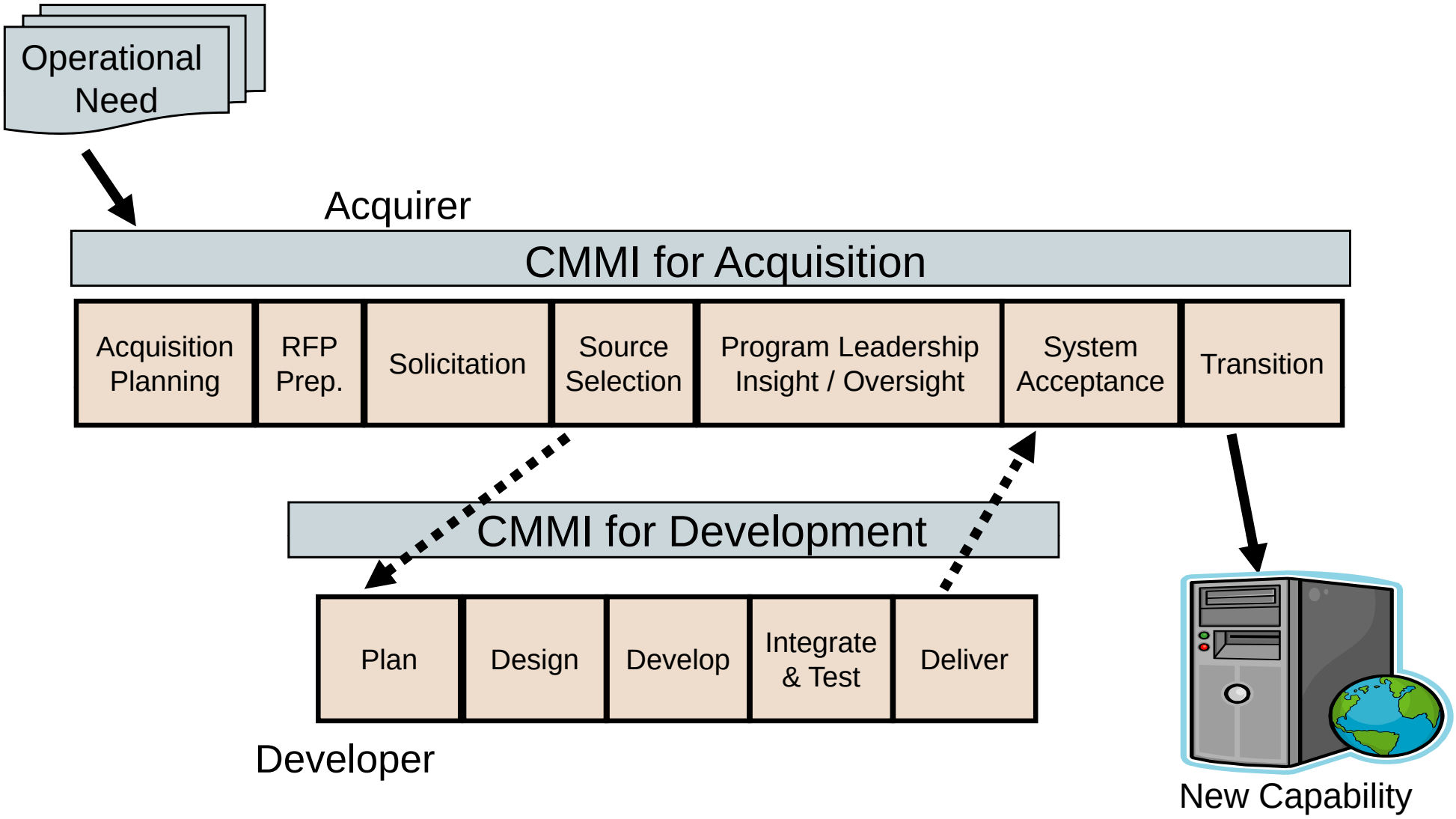
# Inside the Acquirer's Mind - 2

## *What are my team's capabilities?*



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# Why acquisition processes are Important

Improve acquisition office operating practices

- Improve Reviews – documents, PMRs, PDRs, CDRs…
- Improve specific areas: risk mgt, requirements mgt, configuration control, contracting actions (including source selection)
- Improve communications
- Create a “strategic rhythm”
- Facilitate synergy between program segments/organizations, and even among “systems of systems”

Facilitate supplier processes

- Oversight/Insight into supplier processes
- Encourage strategic acquirer-supplier teamwork  that may last for years


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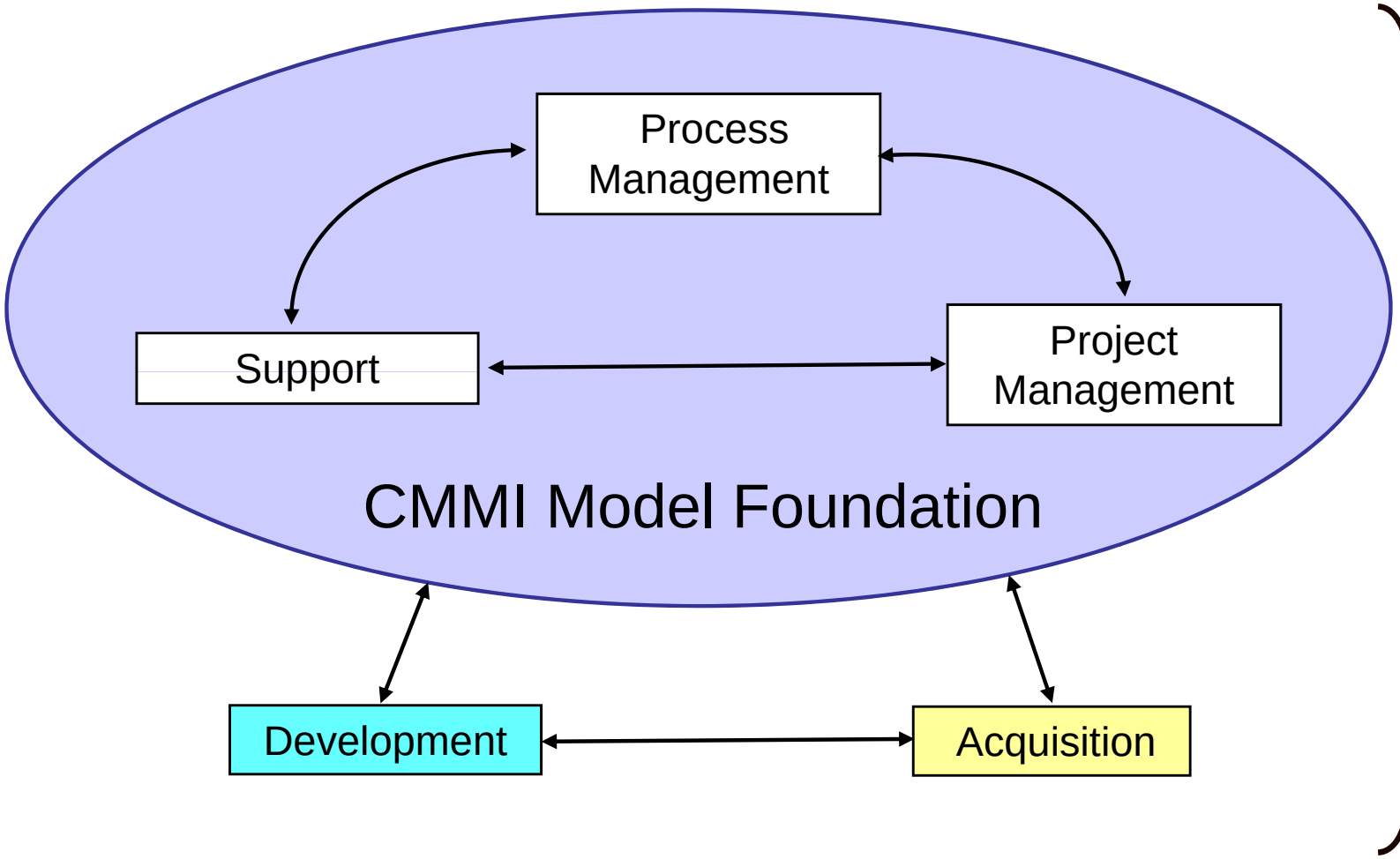
# CMMI Framework Content





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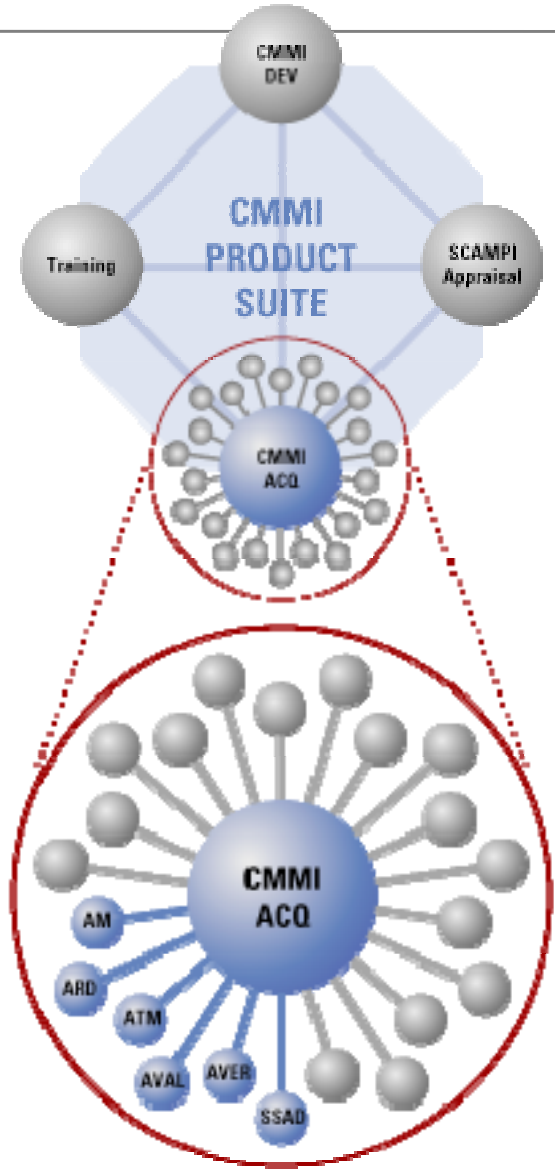
# What is the CMMI Product Suite? - 2

The Product Suite consists of:

- CMMI for Development
- Standard CMMI Appraisal Method for Process Improvement[sm] (SCAMPI[sm])
- Training and Education
- Licensing Opportunities
- and now CMMI for Acquisition





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# CMMI-ACQ Development Challenges

Model must explicitly apply to the acquisition of a wide range of both products and services (From IT outsourcing to DoD acquisition of a weapon system)

Applicable internationally - recognized references and glossary terms added, e.g., service level measurement

Model must apply to acquisition organizations from commercial industry to government agencies, both large and small


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# Advisory Board Membership

| Organization | Name |
|---|---|
| Office of the Secretary of Defense | Kristen Baldwin |
| Navy | Katie Smith |
| Air Force | Bob Swarz |
| Army | Larry Osiecki |
| Defense Contract Management Command | Guy Mercurio |
| Missile Defense Agency | Mike Smith |
| Government Accountability Office | Madhav Panwar |
| General Motors | Rich Frost |
| National Defense Industrial Association | Bob Rassa |


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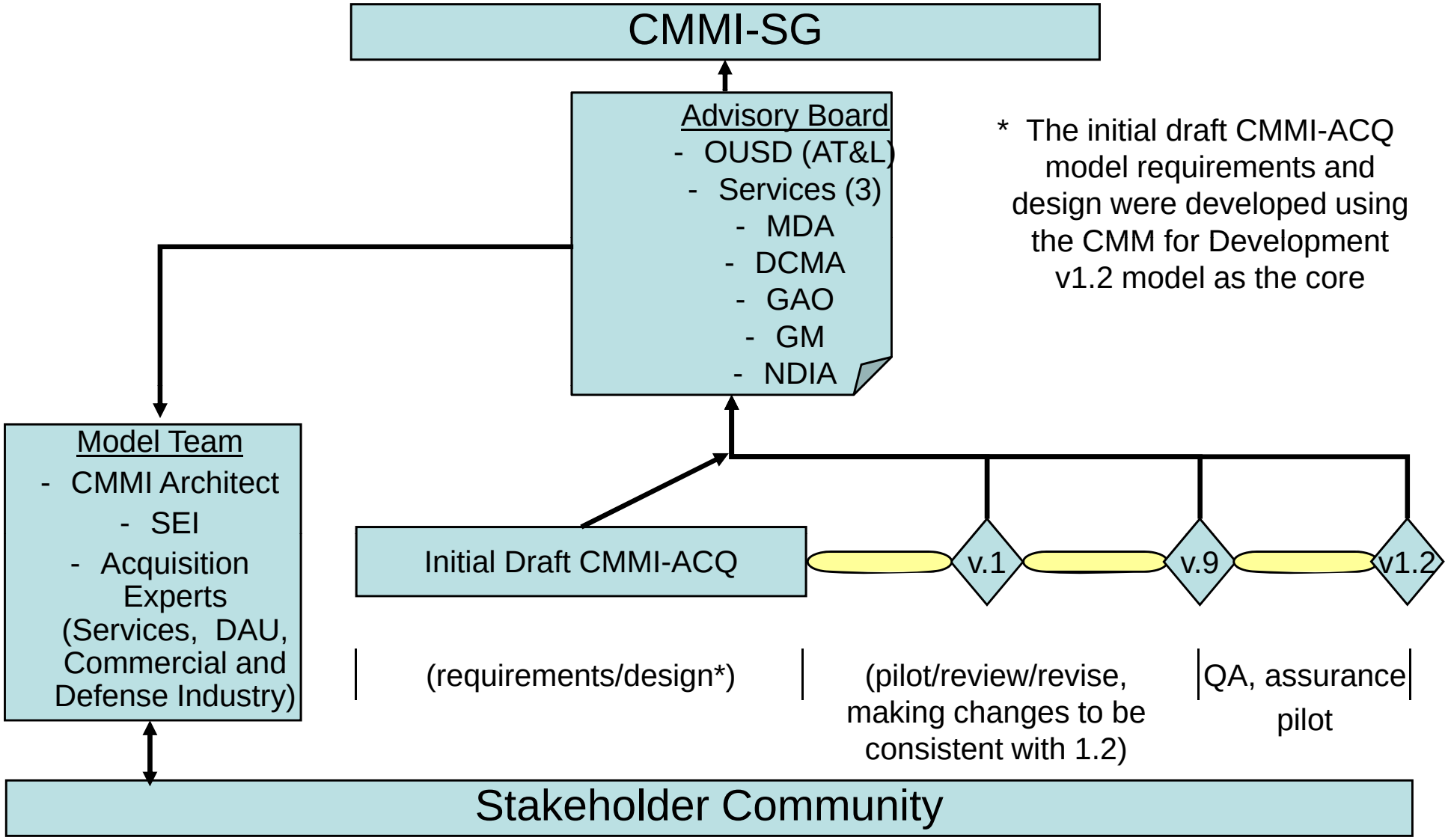
# CMMI-ACQ Development Approach





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# Staged Representation: PAs by Maturity Level

| Maturity Level | Process Areas |
|---|---|
| **Optimizing** | Causal Analysis and Resolution<br>Organizational Innovation and Deployment |
| **Quantitatively Managed** | Quantitative Project Management<br>Organizational Process Performance |
| **Defined** | Organizational Process Focus<br>Organizational Process Definition<br>Organizational Training<br>Integrated Project Management<br>Risk Management<br>Acquisition Technical Management<br>Acquisition Verification<br>Acquisition Validation<br>Decision Analysis and Resolution |
| **Managed** | Acquisition Requirements Development<br>Agreement Management<br>Project Planning<br>Project Monitoring and Control<br>Requirements Management<br>Configuration Management<br>Process and Product Quality Assurance<br>Measurement and Analysis<br>Solicitation and Supplier Agreement Development |


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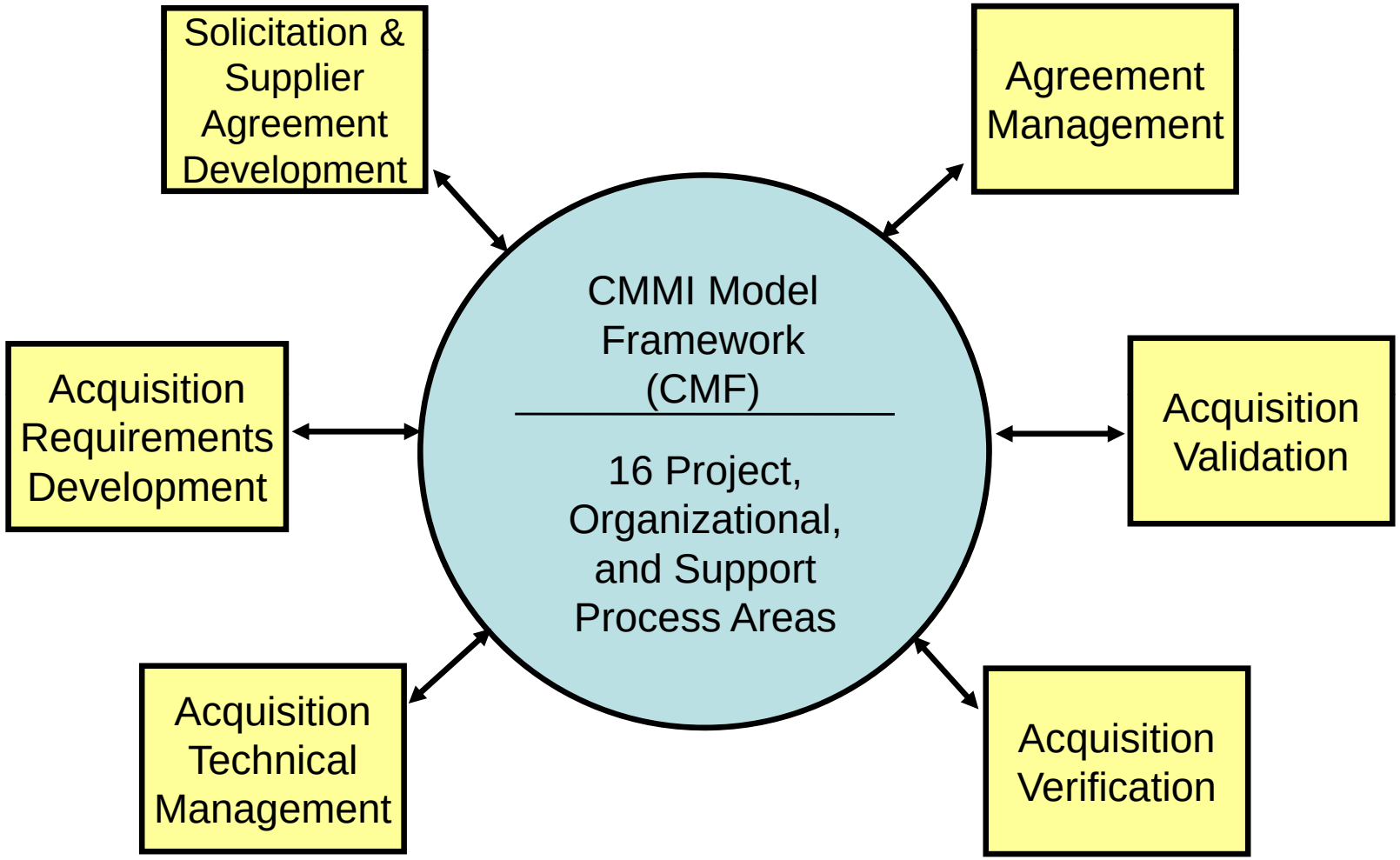
# CMMI-ACQ v1.2
# Acquisition Category Process Areas





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# Acquisition Requirements Development - Goals

SG 1: Develop Customer Requirements

Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.

SG 2: Develop Contractual Requirements

Customer requirements are refined and elaborated to develop contractual requirements.

SG 3: Analyze and Validate Requirements

The requirements are analyzed and validated.


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# Solicitation and Supplier Agreement Development - Goals

SG 1: Prepare for Solicitation and Supplier Agreement Development

Preparation for solicitation and supplier agreement is performed.

SG 2: Select Suppliers

Suppliers are selected based on an evaluation of their ability to meet the specified requirements and established criteria.

SG 3: Establish Supplier Agreements

Supplier agreements are established and maintained.


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# Acquisition Technical Management - Goals

SG 1: Evaluate Technical Solutions

Supplier technical solutions are evaluated to confirm that contractual requirements continue to be met.

SG 2: Perform Interface Management

Selected interfaces are managed.


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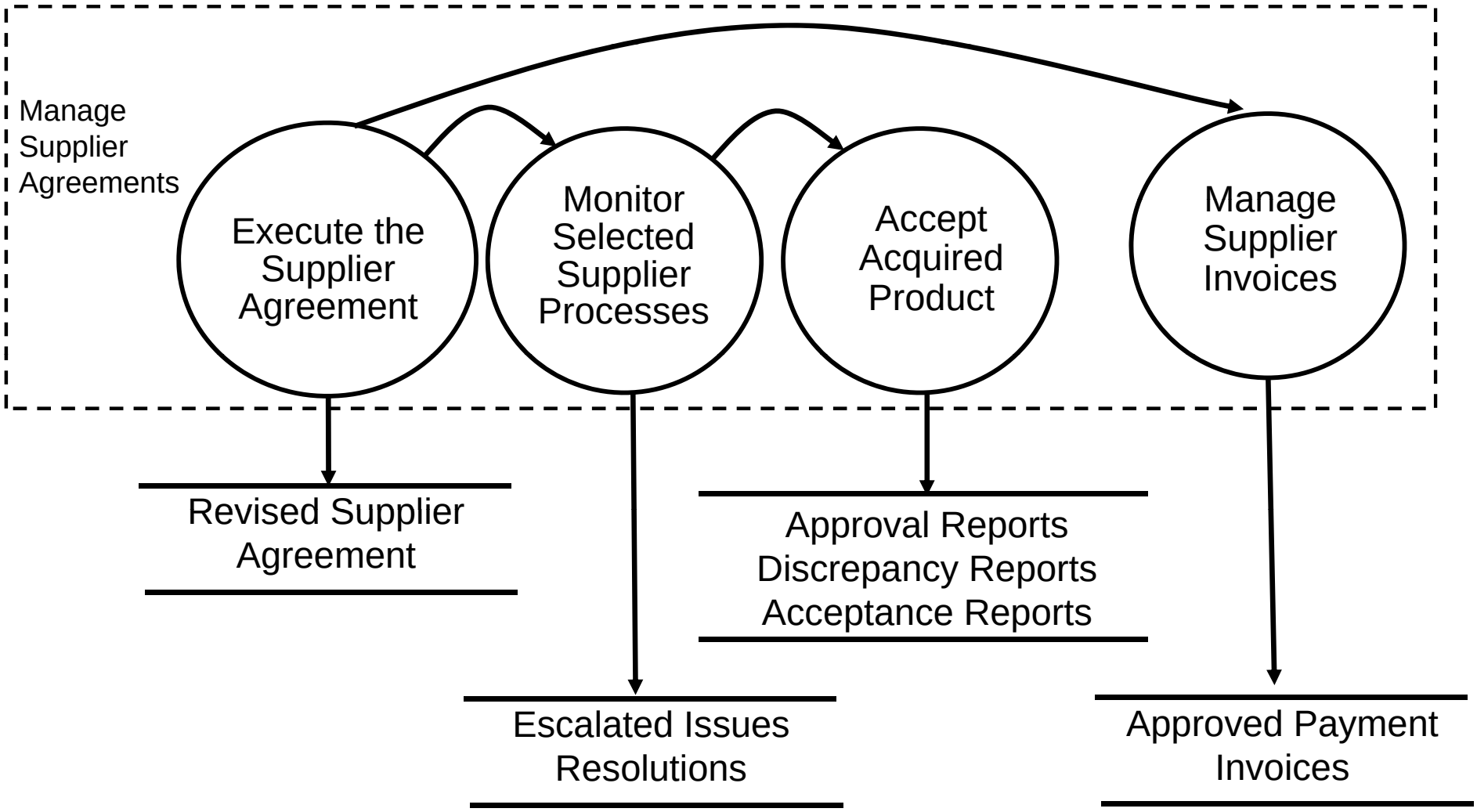
# Agreement Management - Context





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# Acquisition Verification - Specific Goals

SG 1: Prepare for Verification

Preparation for verification is conducted.

SG 2: Perform Peer Reviews

Peer reviews are performed on selected work products.

SG 3: Verify Selected Work Products

Selected work products are verified against their specified requirements.


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# Acquisition Validation - Goals

SG 1: Prepare for Validation

Preparation for validation is conducted.

SG 2: Validate Selected Products and Product Components

Selected products and product components are validated to ensure that they are suitable for use in their intended operating environment.


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# Differences in the CMF

The key additions to the CMF include the following:

- Acquisition Strategy
- Transition to Operations and Support
- Integrated Product and Process Development (Teaming)

There are informative materials unique to the Acquisition Constellation in every process area.


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# Acquisition Strategy

- **Acquisition strategy** - Planning begins with the acquisition strategy that provides the framework for the acquisition project and its plans.
- **PP SP 1.1 Establish and maintain the acquisition strategy.**
- The strategy has the following attributes:
  - used to focus on specifying customer and contractual requirements that express customer value in the Acquisition Requirements Development process area practices.
  - is the business and technical management framework for planning, executing, and managing agreements for a project.
  - relates to the objectives for the acquisition, the constraints, availability of resources and technologies, consideration of acquisition methods, potential supplier agreement types, terms and conditions, accommodation of business considerations, considerations of risk, and support for the acquired product over its lifecycle.
  - reflects the entire scope of the project.
  - encompasses the work to be performed by the acquirer and the work to be performed by the supplier, or in some cases multiple suppliers, for the full lifecycle of the product


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# Transition to Operations and Support

**Transition to operations and support** includes the approach for introducing and maintaining the readiness, sustainment, and operational capability of the product(s) delivered by the supplier.

- PP SP 2.7 - Plan for transition to lifecycle operations and support for the product.
- PMC SP 1.8 - Monitor the transition to operations and support.

Typically, the supplier has a role in integrating and packaging the products and prepares for the transition to operations and support, including support for business user acceptance. The acquirer monitors supplier activities.


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# Integrated Teams - OPD

**Integrated Teams**- The project is managed using integrated teams (IPM SP 1.6) that reflect the organizational rules and guidelines (OPD SP 1.7) for team structuring and forming.

- **OPD SP 1.7 Establish and maintain organizational rules and guidelines for the structure and operation of integrated teams.**

  - In an acquisition organization, integrated teams are useful not just in the acquirer's organization, but between the acquirer and supplier, and among the acquirer, supplier and other relevant stakeholders as appropriate. Integrated teaming may be especially important in a system of systems environment.
  - Operating rules and guidelines for integrated teams define and control how teams are created and how they interact to accomplish objectives.


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# Integrated Teams - IPM

- **IPM SP 1.6 Establish and maintain integrated teams.**
  - The project is managed using integrated teams that reflect the organizational rules and guidelines for team structuring and forming. The project's shared vision is established prior to establishing the team structure, which may be based on the WBS. For small acquirer organizations, the whole organization and the relevant external stakeholders can be treated as an integrated team.
  - Integrated team members must understand the standards for work and participate according to those standards.
  - Structuring the integrated teams involves defining the number of teams, the type of each team, and how each team relates with the others in the structure. Forming the integrated teams involves chartering each team, assigning team members and team leaders, and providing resources to each team to accomplish its work.


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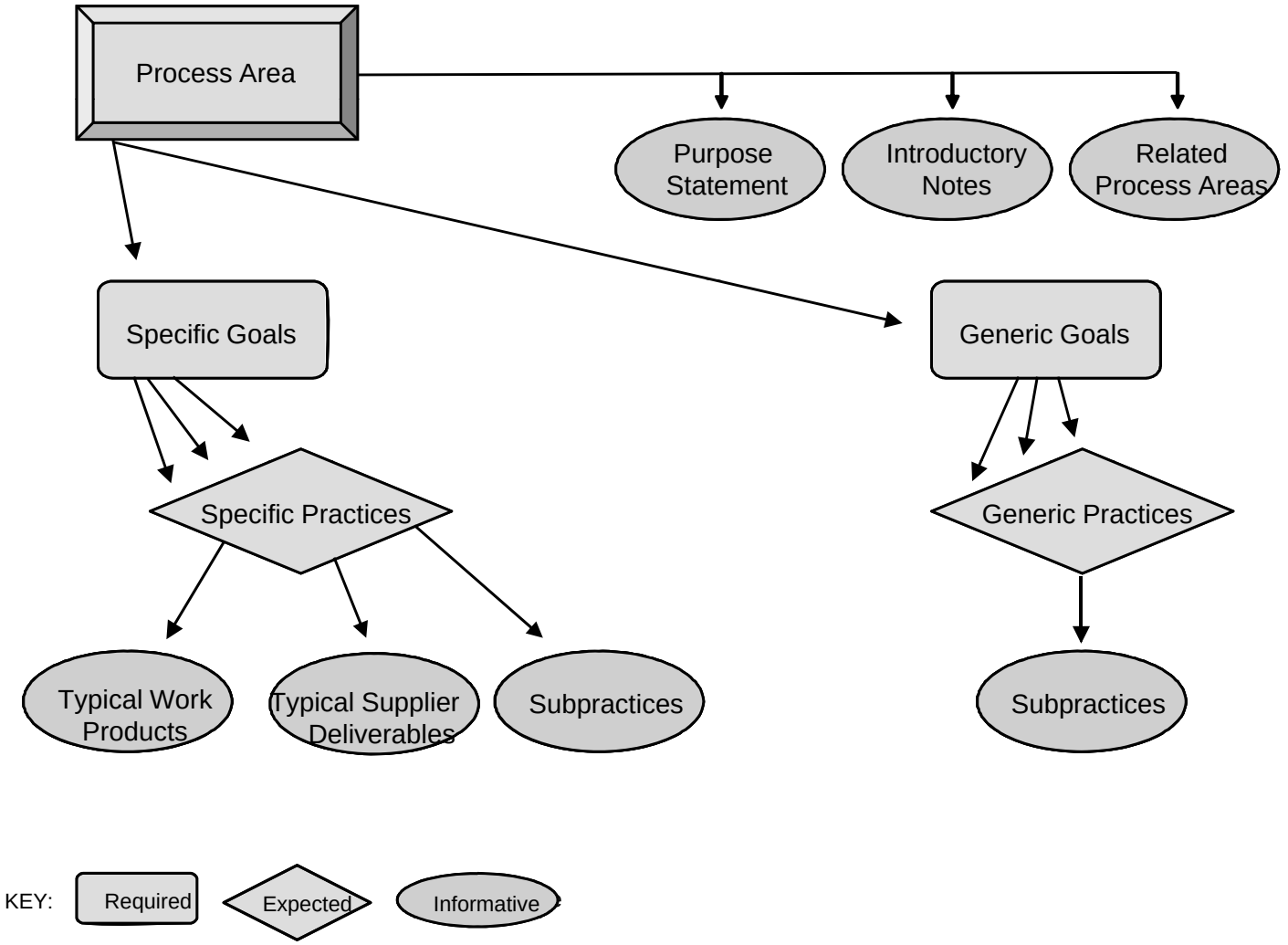
# CMMI Architecture





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# For More Information…

For more information about CMMI

- http://www.sei.cmu.edu/cmmi/ (main CMMI site)

Other Web sites of interest include

- http://seir.sei.cmu.edu/seir/ (Software Engineering Information Repository)
- http://dtic.mil/ndia (annual CMMI Technology Conferences)
- http://seir.sei.cmu.edu/pars (publicly released SCAMPI appraisal summaries)
- https://bscw.sei.cmu.edu/pub/bscw.cgi/0/79783

Or, contact

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